



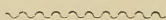
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THE ANNALS  
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MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND  
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,

WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,

AND

WILLIAM FRANCIS, JUN., F.L.S.

VOL. XII.—SEVENTH SERIES.

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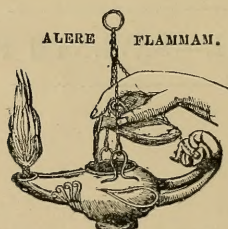
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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . . The sylvan powers  
Obey our summons; from their deepest dells  
The Dryads come, and throw their garlands wild  
And odorous branches at our feet; the Nymphs  
That press with nimble step the mountain-thyme  
And purple heath-flower come not empty-handed,  
But scatter round ten thousand forms minute  
Of velvet moss or lichen, torn from rock  
Or rifted oak or cavern deep: the Naiads too  
Quit their loved native stream, from whose smooth face  
They crop the lily, and each sedge and rush  
That drinks the rippling tide: the frozen poles,  
Where peril waits the bold adventurer's tread,  
The burning sands of Borneo and Cayenne,  
All, all to us unlock their secret stores  
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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[SEVENTH SERIES.]

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"..... per litora spargite muscum,  
Naiades, et circum vitreos considite fontes:  
Pollice virgineo teneros hic carpite flores:  
Floribus et pictum, divæ, replete canistrum.  
At vos, o Nymphæ Craterides, ite sub undas;  
Ite, recurvato variata corallia trunco  
Vellite muscosis e rupibus, et mihi conchas  
Ferte, Deæ pelagi, et pingui conchylia succo.  
N. Parthenii Giannettasi, Ecl. 1.

---

No. 67. JULY 1903.

---

I.—*Report on the Copepoda obtained by Mr. George Murray, F.R.S., during the Cruise of the 'Oceana' in 1898.* By ISAAC C. THOMPSON, F.L.S.

[Plates I.–VII.]

### COPEPODA.

THE Copepoda from the 'Oceana' collection were enclosed in forty bottles, each representing a separate station. They were all taken by tow-net at depths varying from the surface to 1770 fathoms, and were at once preserved in formalin (5 per cent. solution). The collection contained in all 89 species, divided into families as follows:—

Calanidæ . . . . .	35 species.
Centropagidæ . . . . .	29 „
Pontellidæ . . . . .	5 „
Mormonillidæ . . . . .	1 „
Cyclopida . . . . .	3 „
Harpacticidæ . . . . .	8 „
Oncaidæ . . . . .	3 „
Sapphirinidæ . . . . .	2 „
Corycæidæ . . . . .	3 „
<hr/>	
	89 „

Of these, four species are new to science, viz. :—

*Euchæta oceana.*

*Xanthocalanus Giesbrechti.*

*Scolecithrix chelifera.*

*Isochæta longisetosus.*

The males of several species of which the females only were hitherto known have been found, but many of them unfortunately only in an immature stage. The known geographical range of a considerable number of species has been largely increased through this collection. The tow-nets used were open ones and were lowered to ascertained depths and then trailed at the depth indicated and brought open to the surface. Therefore some surface or near surface and intermediate forms may probably have been captured during the descent and ascent of the nets, and should be subtracted from the total catch of the deeper nets. Mr. Murray's method of using the tow-nets during the 'Oceana' cruise is described in a paper by him entitled "Exploration of the Intermediate Depths of the Ocean" (Journal of the Royal Geographical Society, vol. xiii. p. 297, 1899). Some valuable particulars as to the distribution of life at various depths are thus recorded. On p. 6 a table is given showing the depth at each station and also the number of species found. From this it appears generally that the smallest number of species existed at or near the surface, and the largest variety at a depth of 1070 fathoms. Between that and 1510 fathoms the numbers are rather less, but average fairly; while below that, possibly as a coincidence, the numbers decline until the greatest depth of 1770 fathoms was reached. Throughout the paper I have mainly followed the excellent classification and nomenclature of Dr. Giesbrecht, to whom I desire to express my sincere obligations for much help; and I am also greatly indebted to the works of my friends Dr. Brady, F.R.S., and Messrs. T. and A. Scott for valued assistance.

### *List of Species and Stations of Occurrence.*

#### Family CALANIDÆ.

- Calanus finmarchicus*, *Gunner.*—2 b, 2 d, 2 e, 2 f, 4 a, 4 d, 4 f, 4 g, 4 h, 4 j, 4 k, 5 a, 5 b, 5 c, 5 d, 5 e, 5 f, 5 g, 5 h, 5 j, 5 k, 5 l, 6 a, 6 c, 6 d, 6 f, 6 g, 6 h.  
 — *cristatus*, *Krøyer.*—5 h, 5 k, 6 g.  
 — *gracilis*, *Dana.*—2 c, 4 c, 4 h, 5 e, 5 f, 5 g.  
 — *tenuicornis*, *Dana.*—6 h.  
*Eucalanus elongatus*, *Dana.*—5 e, 5 f, 5 g, 5 h, 5 j, 5 k, 5 l, 6 g.  
 — *attenuatus*, *Dana.*—2 f, 2 g, 4 a, 4 d, 4 f, 4 h, 4 k, 5 b, 5 c, 5 d, 5 e, 5 j, 5 k, 5 l, 6 f.

- Rhincalanus nasutus*, *Giesb.*—4 a, 4 d, 4 f, 4 h, 4 j, 4 k, 5 d, 5 e, 5 f, 5 h, 5 j, 5 k, 5 l.  
 — *cornutus*, *Dana.*—4 h, 4 j, 4 k, 5 c, 5 d, 5 e, 5 g, 5 j, 5 k, 6 g.  
*Mecynocera Clausi*, *Thompson.*—2 g, 5 b, 5 d, 5 g.  
*Pseudocalanus elongatus*, *Boeck.*—1 a, 2 a, 1 b, 1 c, 2 b, 2 d, 4 c, 4 d, 4 g, 4 k, 5 a, 5 b, 5 c, 6 b, 6 d, 6 e, 6 h.  
*Spinocalanus abyssalis*, *Giesb.*—4 j.  
*Ætideus armatus*, *Brady.*—2 g, 4 h, 4 j, 4 k, 5 e, 6 b.  
*Bradyidius armatus*, *Vanhöffen.*—4 j, 4 k, 5 b.  
*Gaëtanus miles*, *Giesb.*—2 f, 2 g, 4 a, 4 d, 4 f, 4 k, 5 b, 5 c, 5 e, 5 f, 5 g, 5 h, 5 j, 5 k, 6 f, 6 g, 6 h.  
 — *armiger*, *Giesb.*—4 h, 5 c, 5 d, 5 e, 5 g, 5 h, 5 j.  
*Gaidius pungens*, *Giesb.*—5 g.  
*Euchirella pulchra*, *Lubbock.*—4 c, 4 g.  
 — *rostrata*, *Brady.*—4 g, 6 g.  
 — *curticauda*, *Giesb.*—4 j, 5 c, 5 e, 5 f, 5 h, 5 j, 5 l, 6 f, 6 g.  
*Euchaeta marina*, *Prestand.*—2 c, 2 d, 4 c, 4 d, 4 h, 4 j, 4 k, 4 l, 5 c, 5 d, 5 e, 5 g, 5 h, 5 j, 5 k, 5 l, 6 f, 6 g.  
 — *acuta*, *Giesb.*—4 f.  
 — *Hessei*, *Brady.*—4 g.  
 — *oceana*, sp. n.—4 k, 5 f, 5 k.  
 — *spinosa*, *Giesb.*—5 d, 5 e.  
*Scolecithrix Danæ*, *Lubbock.*—4 j.  
 — *Bradyi*, *Giesb.*—5 f, 5 h.  
 — *auropecten*, *Giesb.*—5 i.  
 — *major*, *T. Scott.*—4 a.  
 — *persecans*, *Giesb.*—5 h.  
 — *securifrons*, *T. Scott.*—5 d, 5 f, 6 f, 6 g.  
 — *frontalis*, *Giesb.*—4 d, 5 e, 5 j, 6 g.  
 — *cristata*, *Giesb.*—5 e.  
 — *chelifer*, sp. n.—5 e, 5 f.  
*Xanthocalanus Giesbrechti*, sp. n.—5 j.  
*Phaëna spinifera*, *Claus.*—2 c, 2 e, 2 f, 4 a, 5 e, 5 h, 5 k.

## Family CENTROPAGIDÆ.

- Centropages typicus*, *Kröyer.*—2 a, 2 d, 2 e, 2 f, 4 k.  
 — *Chierchiai*, *Giesb.*—1 a.  
 — *hamatus*, *Lillj.*—1 a, 2 a, 2 b, 2 c.  
*Metridia longa*, *Lubbock.*—1 c, 2 c, 2 d, 2 e, 2 f, 2 g, 4 b, 4 c, 4 d, 4 f, 4 g, 4 h, 4 j, 4 k, 4 l, 5 a, 5 b, 5 c, 5 d, 5 e, 5 f, 5 g, 5 h, 5 j, 5 k, 5 l, 6 b, 6 c, 6 d, 6 f, 6 g, 6 h.  
 — *venusta*, *Giesb.*—4 j.  
 — *princeps*, *Giesb.*—5 h, 5 k.  
*Pleuromamma abdominalis*, *Giesb.*—2 c, 2 d, 2 e, 2 f, 2 g, 4 b, 4 c, 4 d, 4 f, 4 g, 4 h, 4 j, 4 k, 4 l, 5 b, 5 c, 5 d, 5 e, 5 f, 5 g, 5 h, 5 j, 5 k, 5 l, 6 d, 6 f, 6 g.  
 — *gracilis*, *Claus.*—4 j.  
*Lucicutia longicornis*, *Giesb.*—5 e.  
 — *flavicornis*, *Claus.*—4 f, 4 j, 4 k, 5 c, 5 d, 5 f, 5 g, 5 j, 5 l, 6 g.  
 — *longiserrata*, *Giesb.*—4 f.  
 — *Clausii*, *Giesb.*—6 f.  
*Isochaeta longisetosus*, sp. n.—6 g.  
*Heterorhabdus spinifrons*, *Claus.*—4 h, 4 j, 4 k, 4 l, 5 d, 5 e, 5 f, 5 g, 5 h, 5 j, 5 l, 6 d, 6 f.  
 — *papilliger*, *Claus.*—5 j.  
 — *abyssalis*, *Giesb.*—4 c, 5 e, 5 f.

- Heterorhabdus Clausi*, *Giesb.*—5 *h.*  
 — *vipera*, *Giesb.*—5 *d*, 5 *h.*  
 — *longicornis*, *Giesb.*—5 *j.*  
*Haloptilus longicornis*, *Claus.*—2 *f*, 4 *f*, 4 *g*, 4 *l.*  
 — *ornatus*, *Giesb.*—4 *k*, 5 *c.*  
 — *spiniceps*, *Giesb.*—5 *b.*  
*Augaptilus filigerus*, *Claus.*—4 *d*, 4 *f.*  
 — *palumboi*, *Giesb.*—5 *e.*  
 — *Rattrayi*, *T. Scott.*—5 *e.*  
 — *hecticus*, *Giesb.*—4 *f.*  
 — *longicaudatus*, *Claus.*—5 *e*, 5 *j.*  
*Arietellus setosus*, *Giesb.*—5 *b*, 5 *g.*  
*Phyllopus bidentatus*, *Brady.*—6 *g.*

## Family PONTELLIDÆ.

- Anomalocera Patersoni*, *Templeton.*—1 *a.*  
*Acartia Clausi*, *Giesb.*—1 *b*, 2 *b*, 2 *c*, 2 *d*, 2 *e*, 2 *f*, 2 *g*, 4 *k*, 5 *a*, 5 *b*, 6 *b*, 6 *c*,  
 6 *f*, 6 *g*, 6 *h.*  
 — *longiremis*, *Lillj.*—1 *a*, 2 *a*, 1 *c.*  
 — *discaudata*, *Giesb.*—2 *d.*  
 — *centrura*, *Giesb.*—5 *c.*

## Family MORMONILLIDÆ.

- Mormonilla phasma*, *Giesb.*—4 *f*, 4 *j*, 4 *k*, 5 *c*, 5 *d*, 5 *e*, 5 *h*, 5 *j*, 5 *k.*

## Family CYCLOPIDÆ.

- Oithona similis*, *Claus.*—1 *a*, 2 *a*, 1 *b*, 1 *c*, 2 *b*, 2 *c*, 2 *d*, 2 *e*, 2 *f*, 2 *g*, 4 *a*, 4 *b*,  
 4 *c*, 4 *d*, 4 *f*, 4 *g*, 4 *h*, 4 *j*, 4 *k*, 4 *l*, 5 *a*, 5 *b*, 5 *c*, 5 *d*, 5 *e*, 5 *f*, 5 *g*, 5 *h*,  
 5 *j*, 5 *k*, 5 *l*, 6 *b*, 6 *c*, 6 *e*, 6 *f*, 6 *g*, 6 *h.*  
 — *nana*, *Giesb.*—5 *k.*  
*Thorellia brunnea*, *Boeck.*—2 *b.*

## Family HARPACTICIDÆ.

- Microsetella atlantica*, *Brady & Robertson.*—2 *b*, 2 *c*, 2 *d*, 2 *e*, 2 *f*, 2 *g*, 4 *b*,  
 4 *c*, 4 *d*, 4 *f*, 4 *g*, 4 *h*, 4 *j*, 4 *k*, 5 *c*, 5 *d*, 5 *e*, 5 *f*, 5 *g*, 5 *h*, 5 *j*, 5 *k*, 5 *l*,  
 6 *a*, 6 *b*, 6 *c*, 6 *d*, 6 *h.*  
 — *rosea*, *Dana.*—4 *j*, 4 *k*, 5 *b*, 5 *c*, 5 *d*, 5 *e*, 5 *f*, 5 *g*, 5 *h*, 5 *j*, 6 *a*, 6 *b*, 6 *c*,  
 6 *d*, 6 *f*, 6 *g*, 6 *h.*  
*Setella gracilis*, *Dana.*—4 *d*, 4 *k.*  
*Euterpe acutifrons*, *Dana.*—5 *d.*  
*Delavalia palustris*, *Brady.*—5 *e.*  
*Clytemnestra scutellata*, *Dana.*—5 *d.*  
*Ægisthus mucronatus*, *Giesb.*—2 *f*, 2 *g*, 4 *f*, 4 *h*, 4 *j*, 6 *d*, 6 *f*, 6 *g.*  
 — *aculeatus*, *Giesb.*—4 *b.*

## Family ONCÆIDÆ.

- Oncæa mediterranea*, *Claus.*—4 *d*, 4 *f*, 4 *g*, 4 *h*, 4 *i*, 4 *k*, 5 *b*, 5 *c*, 5 *f*, 5 *g*,  
 5 *h*, 5 *j*, 5 *k*, 5 *l.*  
 — *minuta*, *Giesb.*—4 *d*, 4 *f*, 6 *h.*  
*Conæa rapax*, *Giesb.*—2 *d*, 2 *e*, 2 *f*, 2 *g*, 4 *c*, 4 *d*, 4 *f*, 4 *g*, 4 *h*, 4 *i*, 4 *k*, 5 *b*,  
 5 *d*, 5 *e*, 5 *f*, 5 *g*, 5 *h*, 5 *j*, 5 *k*, 5 *l*, 6 *a*, 6 *b*, 6 *c*, 6 *d*, 6 *f*, 6 *g*, 6 *h.*



Family SAPPHIRINIDÆ.

Sapphirina salpæ, *Claus*.—5 c.  
Lichomolgus liber, *Brady & Robertson*.—2 b.

Family CORYCÆIDÆ.

Corina granulosa, *Giesb.*—5 b.  
Corycæus venustus, *Dana*.—2 f, 2 g.  
— anglicus, *Lubbock*.—2 b, 2 d.

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Table of Stations, Depths, and number of Species found at each.

Station.	Depth (fathoms).	Number of Species found.
1 a.	Surface.	6
2 a.	do.	5
1 b.	20	3
1 c.	50	4
2 b.	270	9
2 c.	270	9
2 d.	374	12
2 e.	464	9
2 f.	620	14
2 g.	650	12
4 a.	Surface.	6
4 a.	1170	12
4 b.	790	5
4 c.	920	10
4 d.	1065	17
4 f.	1275	20
4 g.	1370	12
4 h.	1470	16
4 j.	1570	22
4 k.	1670	24
4 l.	1770	6

Station.	Depth (fathoms).	Number of Species found.
5 a.	Surface.	5
5 b.	500	16
5 c.	810	19
5 d.	950	21
5 e.	1070	32
5 f.	1190	21
5 g.	1300	19
5 h.	1410	24
5 j.	1510	25
5 k.	1610	20
5 l.	1710	14
6 a.	150	4
6 b.	230	8
6 c.	310	7
6 d.	375	9
6 e.	440	2
6 f.	510	15
6 g.	560	20
6 h.	610	11

1 a STATION { Lat. 52° 4' 5 N. } Surface. Nov. 19, 1898.  
 { Long. 11° 20' 1 W. }

Pseudocalanus elongatus.	Anomalocera Patersoni.
Centropages hamatus.	Acartia longiremis.
— Chierchiaë.	Oithona similis.

2 a STATION { Lat. 52° 4' 5 N. } Surface. Nov. 19, 1898.  
 { Long. 12° 27' W. }

Pseudocalanus elongatus.	Acartia longiremis.
Centropages hamatus.	Oithona similis.
— typicus.	

1 b STATION { Lat. 52° 4' 5 N. } 20 fath. Nov. 19, 1898.  
 { Long. 11° 20' 1 W. }

Pseudocalanus elongatus.	Oithona similis.
Acartia Clausi.	

1 c STATION { Lat. 52° 4' 5 N. } 50 fath. Nov. 19, 1898.  
 { Long. 11° 20' 1 W. }

Pseudocalanus elongatus.	Acartia longiremis.
Metridia longa.	Oithona similis.

2 b STATION { Lat. 52° 4' 5 N. } 270 fath. Nov. 19, 1898.  
 { Long. 12° 27' W. }

*Calanus finmarchicus*.  
*Pseudocalanus elongatus*.  
*Centropages hamatus*.  
*Acartia Clausi*.  
*Oithona similis*.

*Thorellia brunnea*.  
*Microsetella atlantica*.  
*Corycæus anglicus*.  
*Lichomolgus liber*.

2 c STATION { Lat. 52° 4' 5 N. } 270 fath. Nov. 19, 1898.  
 { Long. 12° 27' W. }

*Calanus gracilis*.  
*Euchæta marina*.  
*Phaëna spinifera*.  
*Centropages hamatus*.  
*Metridia longa*.

*Pleuromamma abdominalis*.  
*Acartia Clausi*.  
*Oithona similis*.  
*Microsetella atlantica*.

2 d STATION { Lat. 52° 4' 5 N. } 374 fath. Nov. 19, 1898.  
 { Long. 12° 27' W. }

*Calanus finmarchicus*.  
*Pseudocalanus elongatus*.  
*Euchæta marina*.  
*Centropages typicus*.  
*Metridia longa*.  
*Pleuromamma abdominalis*.

*Acartia Clausi*.  
 — discandata.  
*Oithona similis*.  
*Microsetella atlantica*.  
*Corycæus anglicus*.  
*Conæa rapax*.

2 e STATION { Lat. 52° 4' 5 N. } 464 fath. Nov. 19, 1898.  
 { Long. 12° 27' W. }

*Calanus finmarchicus*.  
*Phaëna spinifera*.  
*Centropages typicus*.  
*Metridia longa*.  
*Pleuromamma abdominalis*.

*Acartia Clausi*.  
*Oithona similis*.  
*Microsetella atlantica*.  
*Conæa rapax*.

2 f STATION { Lat. 52° 4' 5 N. } 620 fath. Nov. 19, 1898.  
 { Long. 12° 27' W. }

*Calanus finmarchicus*.  
*Eucalanus attenuatus*.  
*Gaëtanus miles*.  
*Phaëna spinifera*.  
*Centropages typicus*.  
*Haloptilus longicornis*.  
*Metridia longa*.

*Pleuromamma abdominalis*.  
*Acartia Clausi*.  
*Oithona similis*.  
*Microsetella atlantica*.  
*Ægisthus mucronatus*.  
*Corycæus venustus*.  
*Conæa rapax*.

2 g STATION { Lat. 52° 4' 5 N. } 650 fath. Nov. 19, 1898.  
 { Long. 12° 27' W. }

*Eucalanus attenuatus*.  
*Mecynocera Clausi*.  
*Ætideus armatus*.  
*Gaëtanus miles*.  
*Metridia longa*.  
*Pleuromamma abdominalis*.

*Oithona similis*.  
*Acartia Clausi*.  
*Ægisthus mucronatus*.  
*Microsetella atlantica*.  
*Conæa rapax*.  
*Corycæus venustus*.



4 a STATION { Lat. 52° 27'·6 N. } Surface. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

Calanus finmarchicus.	Centropages hamatus.
Mecynocera Clausi.	Pleuromamma abdominalis.
Pseudocalanus elongatus.	Oithona similis.

4 a STATION { Lat. 52° 27'·6 N. } 1170 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

Calanus finmarchicus.	Phaëna spinifera.
Eucalanus attenuatus.	Metridia longa.
Rhincalanus nasutus.	Pleuromamma abdominalis.
Gaëtanus miles.	Oithona similis.
Euchæta marina.	Conæa rapax.
Scolecithrix major.	Microsetella atlantica.

4 b STATION { Lat. 52° 27'·6 N. } 790 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

Metridia longa.	Ægisthus aculeatus.
Pleuromamma abdominalis.	Microsetella atlantica.
Oithona similis.	

4 c STATION { Lat. 52° 27'·6 N. } 920 fath. Nov. 20, 1898.  
 { Long. 15° 40' W. }

Calanus gracilis.	Pleuromamma abdominalis.
Pseudocalanus elongatus.	Heterorhabdus abyssalis.
Euchirella pulchra.	Oithona similis.
Euchæta marina.	Conæa rapax.
Metridia longa.	Microsetella atlantica.

4 d STATION { Lat. 52° 27'·6 N. } 1065 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

Calanus finmarchicus.	Pleuromamma abdominalis.
Eucalanus attenuatus.	Augaptilus filigerus.
Rhincalanus nasutus.	Oithona similis.
Pseudocalanus elongatus.	Conæa rapax.
Gaëtanus miles.	Oncæa mediterranea.
— armiger.	— minuta.
Euchæta marina.	Microsetella atlantica.
Scolecithrix frontalis.	Setella gracilis.
Metridia longa.	

4 f STATION { Lat. 52° 27'·6 N. } 1275 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

Calanus finmarchicus.	Augaptilus hecticus.
Eucalanus attenuatus.	— filigerus.
Rhincalanus nasutus.	Oithona similis.
Gaëtanus miles.	Ægisthus mucronatus.
Euchæta acuta.	Oncæa minuta.
Metridia longa.	— mediterranea.
Pleuromamma abdominalis.	Conæa rapax.
Lucicutia flavicornis.	Microsetella atlantica.
— longiserrata.	— rosea.
Haloptilus longicornis.	Mormonilla phasma.

4 g STATION { Lat. 52° 27'·6 N. } 1370 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

<i>Calanus finmarchicus</i> .	<i>Pleuromamma abdominalis</i> .
<i>Pseudocalanus elongatus</i> .	<i>Haloptilus longicornis</i> .
<i>Euchirella pulchra</i> .	<i>Oithona similis</i> .
— <i>rostrata</i> .	<i>Conæa rapax</i> .
<i>Euchæta Hessei</i> .	<i>Oncaea mediterranea</i> .
<i>Metridia longa</i> .	<i>Microsetella atlantica</i> .

4 h STATION { Lat. 52° 27'·6 N. } 1470 fath. Nov. 20, 1898.  
 { Long. 15° 40' W. }

<i>Calanus finmarchicus</i> .	<i>Metridia longa</i> .
— <i>gracilis</i> .	<i>Pleuromamma abdominalis</i> .
<i>Eucalanus attenuatus</i> .	<i>Heterorhabdus spinifrons</i> .
<i>Rhincalanus nasutus</i> .	<i>Oithona similis</i> .
— <i>cornutus</i> .	<i>Ægisthus mucronatus</i> .
<i>Ætideus armatus</i> .	<i>Conæa rapax</i> .
<i>Gaëtanus armiger</i> .	<i>Oncaea mediterranea</i> .
<i>Euchæta marina</i> .	<i>Microsetella atlantica</i> .

4 j STATION { Lat. 52° 27'·6 N. } 1570 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

<i>Calanus finmarchicus</i> .	<i>Pleuromamma abdominalis</i> .
<i>Rhincalanus nasutus</i> .	— <i>gracilis</i> .
— <i>cornutus</i> .	<i>Lucicutia flavicornis</i> .
<i>Spinocalanus abyssalis</i> .	<i>Heterorhabdus spinifrons</i> .
<i>Ætideus armatus</i> .	<i>Mormonilla phasma</i> .
<i>Bradyidius armatus</i> .	<i>Oithona similis</i> .
<i>Euchirella curticauda</i> .	<i>Microsetella atlantica</i> .
<i>Euchæta marina</i> .	— <i>rosea</i> .
<i>Scolecithrix Danæ</i> .	<i>Oncaea mediterranea</i> .
<i>Metridia longa</i> .	<i>Ægisthus mucronatus</i> .
— <i>venusta</i> .	<i>Conæa rapax</i> .

4 k STATION { Lat. 52° 27'·6 N. } 1670 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

<i>Calanus finmarchicus</i> .	<i>Pleuromamma abdominalis</i> .
<i>Eucalanus attenuatus</i> .	<i>Leucicutia flavicornis</i> .
<i>Rhincalanus nasutus</i> .	<i>Heterorhabdus spinifrons</i> .
— <i>cornutus</i> .	<i>Haloptilus ornatus</i> .
<i>Pseudocalanus elongatus</i> .	<i>Acartia Clausi</i> .
<i>Gaëtanus miles</i> .	<i>Mormonilla phasma</i> .
<i>Bradyidius armatus</i> .	<i>Oithona similis</i> .
<i>Ætideus armatus</i> .	<i>Microsetella atlantica</i> .
<i>Euchæta oceana</i> , sp. n.	— <i>rosea</i> .
— <i>marina</i> .	<i>Setella gracilis</i> .
<i>Centropages typicus</i> .	<i>Oncaea mediterranea</i> .
<i>Metridia longa</i> .	<i>Conæa rapax</i> .

4 l STATION { Lat. 52° 27'·6 N. } 1770 fath. Nov. 20, 1898.  
 { Long. 15° 40'·0 W. }

<i>Euchæta marina</i> .	<i>Haloptilus longicornis</i> .
<i>Metridia longa</i> .	<i>Heterorhabdus spinifrons</i> .
<i>Pleuromamma abdominalis</i> .	<i>Oithona similis</i> .

5 a STATION { Lat. 52° 18'·1 N. } Surface. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

Calanus finmarchicus.	Acartia Clausi.
Pseudocalanus elongatus.	Oithona similis.
Metridia longa.	

5 b STATION { Lat. 52° 18'·1 N. } 500 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

Calanus finmarchicus.	Haloptilus spiniceps.
Eucalanus attenuatus.	Arietellus setosus.
Mecynocera Clausi.	Acartia Clausi.
Bradydium armatus.	Oithona similis.
Pseudocalanus elongatus.	Microsetella rosea.
Gaëtanus miles.	Oncæa mediterranea.
Metridia longa.	Conæa rapax.
Pleuromamma abdominalis.	Corina granulosa.

5 c STATION { Lat. 52° 18'·1 N. } 810 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

Calanus finmarchicus.	Haloptilus ornatus.
Eucalanus attenuatus.	Acartia centrura.
Rhincalanus cornutus.	Lucicutia flavicornis.
Pseudocalanus elongatus.	Mormonilla phasma.
Gaëtanus miles.	Oithona similis.
— armiger.	Microsetella atlantica.
Euchirella curticauda.	— rosea.
Euchæta marina.	Oncæa mediterranea.
Metridia longa.	Sapphirina salpæ.
Pleuromamma abdominalis.	

5 d STATION { Lat. 52° 18'·1 N. } 950 fath. Nov. 21, 1898.  
 { Long. 15° 50'·9 W. }

Calanus finmarchicus.	Lucicutia flavicornis.
Eucalanus attenuatus.	Heterorhabdus spinifrons.
Rhincalanus nasutus.	— vipera.
— cornutus.	Mormonilla phasma.
Mecynocera Clausi.	Oithona spinifrons.
Gaëtanus armiger.	Microsetella atlantica.
Euchæta marina.	— rosea.
— spinosa.	Euterpe acutifrons.
Scolecithrix securifrons.	Clytemnestra scutellata.
Metridia longa.	Conæa rapax.
Pleuromamma abdominalis.	

5 e STATION { Lat. 52° 18'·1 N. } 1070 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

Calanus finmarchicus.	Ætideus armatus.
— gracilis.	Gaëtanus miles.
Eucalanus attenuatus.	— armiger.
— elongatus.	Euchirella curticauda.
Rhincalanus nasutus.	Euchæta marina.
— cornutus.	— spinosa.

*Scolecithrix frontalis*.  
 — auropecten.  
 — cristata.  
 — chelifer.  
*Phaëna spinifera*.  
*Metridia longa*.  
*Pleuromamma abdominalis*.  
*Lucicutia longicornis*.  
*Heterorhabdus abyssalis*.  
 — longicornis.

*Heterorhabdus spinifrons*.  
*Augaptilus longicaudatus*.  
 — palumboi.  
 — Rattrayi.  
*Mormonilla phasma*.  
*Oithona similis*.  
*Microsetella atlantica*.  
 — rosea.  
*Conæa rapax*.  
*Delavalia palustris*.

5 f STATION { Lat. 52° 18'·1 N. } 1190 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

*Calanus finmarchicus*.  
 — gracilis.  
*Eucalanus elongatus*.  
*Rhincalanus nasutus*.  
*Gaëtanus miles*.  
*Euchirella curticauda*.  
*Euchæta oceana*.  
*Scolecithrix Bradyi*.  
 — auropecten.  
 — securifrons.  
 — chelifer.

*Metridia longa*.  
*Pleuromamma abdominalis*.  
*Lucicutia flavicornis*.  
*Heterorhabdus spinifrons*.  
 — abyssalis.  
*Oithona similis*.  
*Microsetella atlantica*.  
 — rosea.  
*Oncæa mediterranea*.  
*Conæa rapax*.

5 g STATION { Lat. 52° 18'·1 N. } 1300 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

*Calanus finmarchicus*.  
 — gracilis.  
*Eucalanus elongatus*.  
*Rhincalanus cornutus*.  
*Mecynocera Clausi*.  
*Gaëtanus miles*.  
 — armiger.  
*Gaidius pungens*.  
*Euchæta marina*.  
*Metridia longa*.

*Pleuromamma abdominalis*.  
*Heterorhabdus spinifrons*.  
*Lucicutia flavicornis*.  
*Arietellus setosus*.  
*Oithona similis*.  
*Microsetella atlantica*.  
 — rosea.  
*Oncæa mediterranea*.  
*Conæa rapax*.

5 h STATION { Lat. 52° 18'·1 N. } 1410 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

*Calanus finmarchicus*.  
 — cristatus.  
*Eucalanus elongatus*.  
*Rhincalanus nasutus*.  
*Euchirella curticauda*.  
*Euchæta marina*.  
 — Hessei, var. similis.  
*Gaëtanus miles*.  
 — armiger.  
*Scolecithrix persecans*.  
 — Bradyi.  
*Phaëna spinifera*.

*Metridia longa*.  
 — princeps.  
*Pleuromamma abdominalis*.  
*Heterorhabdus spinifrons*.  
 — Clausi.  
 — vipera.  
*Mormonilla phasma*.  
*Oithona similis*.  
*Microsetella atlantica*.  
 — rosea.  
*Oncæa mediterranea*.  
*Conæa rapax*.



5 j STATION { Lat. 52° 18'·1 N. } 1510 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

*Calanus finmarchicus*.  
*Eucalanus elongatus*.  
 — *attenuatus*.  
*Rhincalanus nasutus*.  
 — *cornutus*.  
*Gaëtanus miles*.  
 — *armiger*.  
*Euchirella curticauda*.  
*Euchæta marina*.  
*Scolecithrix frontalis*.  
 — *auropecten*.  
*Xanthocalanus Giesbrechti*.  
*Metridia longa*.

*Pleuromamma abdominalis*.  
*Lucicutia flavicornis*.  
*Heterorhabdus spinifrons*.  
 — *longicornis*.  
 — *papilliger*.  
*Augaptilus longicaudatus*.  
*Mormonilla phasma*.  
*Oithona similis*.  
*Microsetella atlantica*.  
 — *rosea*.  
*Oncaea mediterranea*.  
*Conæa rapax*.

5 k STATION { Lat. 52° 18'·1 N. } 1610 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

*Calanus finmarchicus*.  
 — *cristatus*.  
*Eucalanus elongatus*.  
 — *attenuatus*.  
*Rhincalanus nasutus*.  
 — *cornutus*.  
*Gaëtanus miles*.  
*Euchæta marina*.  
 — *oceana*.  
*Phaëna spinifera*.

*Metridia longa*.  
 — *princeps*.  
*Pleuromamma abdominalis*.  
*Lucicutia longicornis*.  
*Mormonilla phasma*.  
*Oithona similis*.  
 — *nana*.  
*Microsetella atlantica*.  
*Oncaea mediterranea*.  
*Conæa rapax*.

5 l STATION { Lat. 52° 18'·1 N. } 1710 fath. Nov. 21, 1898.  
 { Long. 15° 53'·9 W. }

*Calanus finmarchicus*.  
*Eucalanus attenuatus*.  
 — *elongatus*.  
*Rhincalanus nasutus*.  
*Euchirella curticauda*.  
*Euchæta marina*.  
*Metridia longa*.

*Pleuromamma abdominalis*.  
*Heterorhabdus spinifrons*.  
*Lucicutia flavicornis*.  
*Oithona similis*.  
*Microsetella atlantica*.  
*Oncaea mediterranea*.  
*Conæa rapax*.

6 a STATION { Lat. 52° 20' N. } 150 fath. Nov. 22, 1898.  
 { Long. 15° 7'·9 W. }

*Calanus finmarchicus*.  
*Microsetella atlantica*.

*Microsetella rosea*.  
*Conæa rapax*.

6 b STATION { Lat. 52° 20' N. } 230 fath. Nov. 22, 1898.  
 { Long. 15° 7'·9 W. }

*Pseudocalanus elongatus*.  
*Ætideus armatus*.  
*Metridia longa*.  
*Acartia Clausi*.

*Oithona similis*.  
*Microsetella atlantica*.  
 — *rosea*.  
*Conæa rapax*.

6 c STATION { Lat. 52° 20' N. } 310 fath. Nov. 22, 1898.  
                   { Long. 15° 7'·9 W. }

*Calanus finmarchicus*.  
*Metridia longa*.  
*Acartia Clausi*.  
*Oithona similis*.

*Microsetella atlantica*.  
 — rosea.  
*Conæa rapax*.

6 d STATION { Lat. 52° 20' N. } 375 fath. Nov. 22, 1898.  
                   { Long. 15° 7'·9 W. }

*Calanus finmarchicus*.  
*Pseudocalanus elongatus*.  
*Metridia longa*.  
*Pleuromamma abdominalis*.  
*Heterorhabdus spinifrons*.

*Microsetella atlantica*.  
 — rosea.  
*Ægisthus mucronatus*.  
*Conæa rapax*.

6 e STATION { Lat. 52° 20' N. } 440 fath. Nov. 22, 1898.  
                   { Long. 15° 7'·9 W. }

*Pseudocalanus elongatus*.

*Oithona similis*.

6 f STATION { Lat. 52° 20' N. } 510 fath. Nov. 22, 1898.  
                   { Long. 15° 7'·9 W. }

*Calanus finmarchicus*.  
*Eucalanus attenuatus*.  
*Gaëtanus miles*.  
*Euchæta marina*.  
*Euchirella curticauda*.  
*Scolecithrix securifrons*.  
*Metridia longa*.  
*Pleuromamma abdominalis*.

*Lucicutia Clausi*.  
*Heterorhabdus spinifrons*.  
*Acartia Clausi*.  
*Oithona similis*.  
*Microsetella rosea*.  
*Ægisthus mucronatus*.  
*Conæa rapax*.

6 g STATION { Lat. 52° 20' N. } 560 fath. Nov. 22, 1898.  
                   { Long. 15° 7'·9 W. }

*Calanus finmarchicus*.  
 — cristatus.  
*Eucalanus elongatus*.  
*Rhincalanus cornutus*.  
*Gaëtanus miles*.  
*Euchirella curticauda*.  
 — rostrata.  
*Euchæta marina*.  
*Scolecithrix frontalis*.  
 — securifrons.

*Metridia longa*.  
*Pleuromamma abdominalis*.  
*Lucicutia flavicornis*.  
*Isochæta longisetosus*.  
*Phyllopus bidentatus*.  
*Acartia Clausi*.  
*Oithona similis*.  
*Microsetella rosea*.  
*Ægisthus mucronatus*.  
*Conæa rapax*.

6 h STATION { Lat. 52° 20' N. } 610 fath. Nov. 22, 1898.  
                   { Long. 15° 7'·9 W. }

*Calanus finmarchicus*.  
 — tenuicornis.  
*Pseudocalanus elongatus*.  
*Gaëtanus miles*.  
*Metridia longa*.  
*Acartia Clausi*.

*Oithona similis*.  
*Microsetella rosea*.  
 — atlantica.  
*Onæa minuta*.  
*Conæa rapax*.

*Calanus finmarchicus*, Gunner.

1765. *Monoculus finmarchicus*, Gunner, Skr. Kjöbenh. Selsk. vol. x. p. 175, figs. 20-23.

This, probably the most abundant and widely distributed of all known Copepoda, occurred in twenty-five of the forty stations and at all depths from the surface to 1710 fathoms.

*Calanus cristatus*, Kröyer.

1848. *Calanus cristatus*, Kröyer, Naturh. Tidsskr. n. ser. vol. ii. pp. 547, 553, 607.

Three specimens only of this little-known species occurred in three separate gatherings at depths from 560 to 1510 fathoms. All appeared to be immature females, which, as Giesbrecht points out, is the only form known.

*Calanus gracilis*, Dana.

1849. *Calanus gracilis*, Dana, P. Amer. Ac. vol. ii. pp. 18, 24.

Its long graceful antennæ easily distinguish this species from all other *Calani*. It was sparingly found at six stations at depths of from 270 to 1300 fathoms.

*Calanus tenuicornis*, Dana.

1849. *Calanus tenuicornis*, Dana, *op. cit.* vol. ii. p. 15.

One specimen was found at 6 h Station at a depth of 610 fathoms, and two others at greater depth, the latter in an immature state.

*Eucalanus elongatus*, Dana.

1849. *Calanus* (part.), Dana, *op. cit.* vol. ii. p. 10.

This large and easily recognized species occurred at seven stations at from 560 to 1710 fathoms.

*Eucalanus attenuatus*, Dana.

1849. *Calanus attenuatus*, Dana, *op. cit.* vol. ii. p. 18.

Similar in appearance to *E. elongatus*, but readily distinguishable from the latter by its three-jointed abdomen, that species having four joints. It occurred at fifteen stations, only two of them, however, being those where *E. elongatus* was found, although at similar depths—920 to 1710 fathoms.

*Rhincalanus nasutus*, Giesbrecht.

1888. *Rhincalanus nasutus*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. iv. p. 334.

One of the largest of known Copepoda. It was very plentiful at the thirteen stations in which it occurred.

*Rhincalanus cornutus*, Dana.

1849. *Calanus cornutus*+*C. rostrifrons*, op. cit. vol. ii. p. 19.

Less plentiful than *R. nasutus*, occurring at ten stations and at similar depth to the latter—from 560 to 1710 fathoms.

*Mecynocera Clausi*, Thompson.

1888. *Mecynocera Clausi*, Thompson, Journ. Linn. Soc., Zool. vol. xx. p. 150.

A few specimens of this species, easily recognized by its long delicate antennæ, were found at four stations at depths from 500 to 1300 fathoms.

*Pseudocalanus elongatus*, Boeck.

1864. *Clausia elongata*, Boeck, Forh. Selsk. Christian. p. 10.

One of the commonest species round our own shores. It was present in nearly half the bottles of this collection, and at all depths from the surface to 1710 fathoms.

*Spinocalanus abyssalis*, Giesbrecht. (Pl. I. fig. 6.)

1888. *Spinocalanus abyssalis*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. iv. p. 235.

One specimen only, an immature male, was taken at 1570 fathoms. Fig. 6 shows the rudimentary fifth feet. The male of this species has not been previously reported.

*Ætideus armatus*, Brady.

1883. *Ætidiu armatus*, Brady, Rep. Voy. 'Challenger,' vol. viii. p. 75.

Occurs at six stations at depths between 230 and 1670 fathoms. As remarked by Brady, "the strong curved rostrum and the remarkably elongated, spiniform, posterior thoracic segment distinguish this species at a glance from any other with which I am acquainted."

*Bradyidius armatus*, Vanhöffen.

1878. *Pseudocalanus armatus*, Brady, Cop. Brit. Isl. vol. i. p. 46.

The hitherto recorded area of distribution of this species



appears to be confined to British shores and as far north as Greenland. It occurs three times in this collection at depths of from 500 to 1670 fathoms.

*Gaëtanus miles*, Giesbrecht. (Pl. I. figs. 3, 4, 5.)

1888. *Gaëtanus miles*, Giesbrecht, Atti Acc. Lincei Rend. vol. iv. p. 335.

One or more of this readily recognized species occurred at 17 stations, almost all being females, and the few males found were immature. Noticing some slight variations between my specimens and Dr. Giesbrecht's figures, I sent some to Dr. Giesbrecht for identification, and received from him the following remarks upon them. He says:—"I believe them to be identical with *Gaëtanus miles*. There is resemblance in all specific characters I made out for *G. miles*, only the lamella on the basal joint of the maxillipeds is of somewhat different form, and there is a greater number of spiniform setæ on the inner margin of basal joint of the fourth foot in your specimen. My specimens of *G. miles* came from the Pacific, yours are Atlantic, so the named differences will be geographical varieties."

*Gaëtanus armiger*, Giesbrecht.

1888. *Gaëtanus armiger*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. iv. p. 335.

Less plentiful than the preceding species, being found at seven stations and very sparingly. Like the preceding, it has been hitherto reported by Giesbrecht from the Pacific Ocean and by Mr. T. Scott from the Gulf of Guinea only; so the known range of distribution of both is now widely extended.

*Gaidius pungens*, Giesbrecht. (Pl. I. fig. 7.)

1895. *Gaidius pungens*, Giesbrecht, Bull. Mus. Harvard, vol. xxv. p. 349.

One specimen only was found at Station 5 *g*—an immature male,—at a depth of 1300 fathoms. As the first male, I believe, recorded, it is unfortunate that it should be immature. Giesbrecht's previous record is the Pacific Ocean; so here again we have a widely extended range.

*Euclirella pulchra*, Lubbock.

1856. *Undina pulchra*, Lubbock, Tr. Ent. Soc. n. ser. vol. iv. p. 20.

Two specimens only were found at depths of 920 and 1370 fathoms.

*Euchirella rostrata*, Claus.

1866. *Undina rostrata*, Claus, Cop. Nizza, p. 11.

Two specimens were found at 560 and 1370 fathoms respectively.

*Euchirella curticauda*, Giesbrecht.

1888. *Euchirella curticauda*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. iv. p. 336.

Comparatively common throughout the collection, occurring at nine stations at varying depths from 810 to 1710 fathoms.

The crested head without rostrum, coupled with the dwarfed abdomen and caudal segments, easily distinguish this species.

*Euchæta marina*, Prestandrea.

1833. *Cyclops marinus*, Prestandrea, Effemeridi scientifiche e letterarie per la Sicilia, Palermo, vol. vi. p. 12.

A very widely distributed species throughout the Mediterranean and the Atlantic and Pacific Oceans, and occurring in the present collection at eighteen stations and at varying depths from 270 to 1770 fathoms.

*Euchæta acuta*, Giesbrecht.

1892. *Euchæta acuta*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 246.

One specimen only, a female, was taken at 1275 fathoms. It appears not to have been before reported except from the Mediterranean.

*Euchæta Hessei*, Brady.

1883. *Euchæta Hessei*, Brady, Rep. Voy. 'Challenger,' vol. viii. p. 63.

One specimen only apparently of this species was taken at 1370 fathoms. It had the strong prominent rostrum as described and figured by Brady, but being an immature specimen, a male, the fifth feet were not so complete as those he figures.

*Euchæta Hessei*, var. *similis*, T. Scott.

1893. *Euchæta Hessei*, var. *similis*, T. Scott, Tr. Linn. Soc. ser. 2, Zool. vol. vi. p. 58, pl. vi.

One specimen only, a male, was obtained at 1410 fathoms. It agreed in all respects with Scott's description of his variety of *E. Hessei*.

*Euchæta spinosa*, Giesbrecht.

1892. *Euchæta spinosa*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 246.

A few specimens of this species, all females, occurred at two stations at depths of 950 and 1070 fathoms.

*Euchæta oceana*, sp. n. (Pl. II. figs. 1-9.)

Length 6 millim. Cephalothorax (fig. 1) ovate, 4-jointed, first joint longer than the following three put together. Anteriorly there is a rounded central knob between the antennæ. Rostrum arising dorsally and looking like a central thorn. Eyes prominent. Anterior antennæ of the male 21-jointed, the relative lengths being as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
8	6	3	4	4	4	5	10	3	4	3	4	8	8	8	8	9	16	9	8	8

Short setæ extend along the upper surface, with long stout ones on the third, eighth, and twelfth joints. On the third to eighth joints are triangular-shaped papillæ (fig. 2)—two on each joint—a thin hair springing from the centre of each, the apex having a granular appearance. The branches of the posterior antennæ (fig. 3) are of nearly equal length. Maxilla (fig. 4) has numerous long stout bristles. Mandible (fig. 5) altogether devoid of any biting part, as is also the case with most species of *Euchæta*. First pair of foot-jaws appear to be entirely absent, which is also a feature of the males of other species of this genus. The outer branch of the first four pairs of swimming-feet is 3-jointed. Inner branch of first pair (fig. 7) 1-jointed, second pair 2-jointed, and third and fourth pairs (fig. 8) 3-jointed. Fifth pair long and prehensile (fig. 9); the inner joint of each foot is 1-jointed. The right outer branch is 3-jointed, terminating in a strong spine. The left branch is 4-jointed, terminating in a strong spine, with fine setæ on the inner side near the apex and a small spine. Abdomen 5-jointed, the first segment very small. Caudal segments are rather longer than the breadth, and have a pair of small rounded papillæ between them.

Three specimens of this fine species (all males) were found in three separate bottles taken at depths of 1190 to 1670 fathoms. None appeared to be fully matured, the figures being taken from the one most fully developed. The rostrum, anterior antennæ, and fifth feet are the chief distinguishing features of this species.

*Scolecithrix Danæ*, Lubbock.

1856. *Undina Danæ*, Lubbock, Tr. Ent. Soc. Lond. n. ser. vol. iv. p. 15.

The genus *Scolecithrix* has proved to be the best represented in this collection, furnishing nine species, one of them (*S. chelififer*) being new to science. The species before us—*S. Danæ*—one of the most widely diffused throughout the great oceans, occurs only once in the present collection at a depth of 1570 fathoms.

*Scolecithrix Bradyi*, Giesbrecht.

1888. *Scolecithrix Bradyi*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. iv. p. 337.

About as widely distributed as the previous species, occurring here at two stations at depths of 1190 and 1410 fathoms.

*Scolecithrix auropecten*, Giesbrecht.

1892. *Scolecithrix auropecten*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 266.

One specimen (a female), agreeing in all respects with Giesbrecht's description, was found at 1510 fathoms. The male remains unknown.

*Scolecithrix major*, T. Scott.

1893. *Scolecithrix major*, T. Scott, Tr. Linn. Soc. ser. 2, Zool. vol. vi. p. 52.

This appears to be a very rare species, the only previous record by Mr. Scott being one specimen from the Gulf of Guinea, with which my only specimen taken at 920 fathoms agrees.

*Scolecithrix persecans*, Giesbrecht.

1895. *Scolecithrix persecans*, Giesbrecht, Bull. Mus. Harvard, vol. xxv. p. 253.

One specimen (a male fully matured) was taken at 1410 fathoms. Its peculiar long prehensile fifth feet figured by Giesbrecht are very diagnostic. The female is unknown. Giesbrecht's specimen was from the Pacific, mine from the Atlantic, so increasing its known range.

*Scolecithrix securifrons*, T. Scott.

1893. *Scolecithrix securifrons*, T. Scott, Tr. Linn. Soc. ser. 2, Zool. vol. vi. p. 47.

Several specimens of this species, easily recognizable by



its high median crested head, were found at four stations at depths from 510 to 1190 fathoms.

*Scolecithrix frontalis*, Giesbrecht.

1895. *Lophothrix frontalis*, Giesbrecht, Bull. Mus. Harvard, vol. xxv. p. 254.

A few specimens were found at four stations at a depth of from 560 to 1510 fathoms. All were females, the male being unknown. It had previously only been reported from the Pacific Ocean.

*Scolecithrix cristata*, Giesbrecht. (Pl. III. figs. 1-5.)

1893. *Amalophora magna*, T. Scott, Tr. Linn. Soc. ser. 2, Zool. vol. vi. p. 55.

Two specimens (male and female) were found at two separate stations at depths of 950 and 1070 fathoms. As the male was hitherto unknown, its characteristic points are appended.

Length  $3\frac{1}{2}$  millim. Head has small but moderately long crest (fig. 1) extending to almost between the eyes. Anterior antennæ (fig. 2) not quite so long as the cephalothorax, the relative lengths of the twenty-two joints being about as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
4	6	3	3	3	3	3	4	2	5	2	4	4	5	5	5	5	5	9	3	3	3*

The two branches of the posterior antennæ (fig. 3) are of nearly equal length. The first four pairs of swimming-feet similar to those of the female. The fifth pair (fig. 4) two-branched, prehensile, one having a secondary club-like branch. The main branch of same has a long curved elaborate apical termination (fig. 5). A single small spine projects from the outer side, the inner siding having first a raised wedge-shaped surface bearing short setæ, then four strong teeth, and terminating in a series of transverse striations. The other branch terminates with a long and a short strong spine.

*Scolecithrix chelifer*, sp. n. (Pl. V. figs. 1-9.)

Length 6.0 millim. Cephalothorax (fig. 1) obtusely ovate, 4-jointed. Upper portion of head flattened, with sharp double rostrum. Anterior antennæ (fig. 2) 23-jointed, the proportional length of each joint being about as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
3	5	2	2	2	2	2	4	2	2	3	4	4	5	5	5	5	5	4	4	3	4	6.

Outer branch of posterior antennæ (fig. 3) about  $1\frac{1}{4}$  times as long as the inner branch. Mandible (fig. 4) consists of a large powerful rounded claw, bearing a spine on the outer edge. One of the two branches bears a long 2-jointed plumose spine, and, like the other branch, several long slender spines. Anterior foot-jaw bears five branches, the first having on the outer side nine or ten crook-shaped hairs; the others have two to six long apical spines. Posterior foot-jaw (fig. 6) 4-jointed; the second joint on outer side fringed with numerous short spines; the fourth joint has several apical long spines, two of them having lateral teeth on one side. Outer branch of first to fourth pair of swimming-feet 3-jointed, the inner branch of first pair 1-jointed, that of the second pair (fig. 7) 2-jointed, and of the third and fourth 3-jointed. A peculiarity of the second, third, and fourth pairs consists in their having a partial second row of tooth-like serrations (fig. 8) on the terminal spines.

The only two specimens found were immature males, the fifth pair of feet of one of them being represented (fig. 9). Each of the two branches is composed of four joints; they are, however, asymmetrical, all the joints of one, with the exception of the ultimates, being considerably larger than the corresponding ones of the other branch. The terminal joints of each have three apical spines, the central the largest, and one inner lateral spine. The two specimens were found at 1070 and 1190 fathoms. I have named the species *S. chelifer*, on account of the remarkable claw on the mandibles: the name must not be confounded with Giesbrecht's *S. chelipes*.

*Xanthocalanus Giesbrechti*, sp. n. (Pl. IV. figs. 1-9.)

*Female*.—Length  $3\frac{1}{2}$  millim. Body lengthened ovate. Rostrum absent. Cephalothorax (fig. 1) 5-jointed. Anterior antennæ (fig. 2) 25-jointed, the proportional lengths of the joints being about as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
7	11	6	4	6	5	5	10	6	7	8	9	9	11	10	11	10	10	8	8	7	9	10	8	3

Outer branch of the posterior antennæ (fig. 3) about  $1\frac{1}{2}$  times as long as the inner branch. Mandible (fig. 4) 2-branched; basal segment has three long bristles on upperside; biting portion with long narrow palp. Maxilla very setose (fig. 5). Anterior foot-jaw (fig. 6) 5-branched, each terminating with several long plumed setæ. Posterior foot-jaw (fig. 7)

6-jointed. Outer branch of first to fourth pair of swimming-feet 3-jointed. Inner branch of first pair 1-jointed, but double-lobed, as in *Gaëtanus*. Inner branch of second pair (fig. 8) 2-jointed, and that of the third and fourth pairs 3-jointed. Fifth pair 2-branched (fig. 9), each 3-jointed, including basal joint, the apical joint of the right branch having four spines, the left three spines, the first two joints of each branch having their inner edges lined with short strong spines. Abdomen 4-jointed, the last very small; caudal segments somewhat quadrate, nearly twice as long as broad.

One specimen only (a female) was found at 1510 fathoms, and it is with extreme pleasure that I name it after Dr. Giesbrecht of Naples, whose colossal and magnificent book, as well as his many lesser writings, and personal friendship when at Naples on various occasions, have been of the greatest service to me.

*Phaënnia spinifera*, Claus.

1863. *Phaënnia spinifera*, Claus, Freileb. Cop. p. 189.

A fair number of this widely distributed species were taken at seven stations, at depths varying from 270 to 1610 fathoms.

*Centropages typicus*, Kröyer.

1848. *Centropages typicus*, Kröyer, Naturh. Tidsskr. n. ser. vol. ii. p. 588.

This well-known British species, whose further known range is the Mediterranean and the Atlantic Ocean, occurred at five stations in this collection at depths of from 270 to 1670 fathoms.

*Centropages Chierchiæ*, Giesbrecht.

1889. *Centropages Chierchiæ*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 811.

One specimen was taken by the surface-net. Its only previous record is from the Straits of Gibraltar.

*Centropages hamatus*, Lillj.

1853. *Ichthyophorba hamata*, Lillj. Clad. Ostr. Cop. p. 185.

Another of our common British species, also previously recorded from the Atlantic and from its first-known habitat, the Baltic. It occurs at four stations in the 'Oceana' collection, from the surface to 270 fathoms.

*Metridia longa*, Lubbock.

1854. *Calanus longus*, Lubbock, Ann. & Mag. Nat. Hist. ser. 2, vol. xiv. p. 127.

One of the commonest species in the collection. Found in thirty-three out of the forty bottles comprising the collection, at depths from 50 to 1770 fathoms.

*Metridia venusta*, Giesbrecht. (Pl. VI. figs. 1, 2.)

1889. *Metridia venusta*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 24.

One specimen only, and fortunately a mature male, hitherto unknown, was taken at 1570 fathoms. The general characters agree with those of the female as described by Giesbrecht, the anterior antennæ and fifth pair of swimming-feet being the main differences between the sexes.

The right anterior antenna is 26-jointed, the left 23-jointed, the latter being geniculated between the seventeenth and eighteenth joints; both are very thin in the latter half. The proportionate lengths of the joints of the left antenna are as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
9	3	3	3	3	3	2	2	3	3	3	5	6	7	8	7	3	10	6	6	8	7	2

The fifth pair of feet (fig. 2) are very elaborate; each is 2-branched, the outer ones are 4-jointed and terminated by strong spines, the left spine being more than double the length of the right. The inner branch of each foot is 3-jointed, each apical joint having two lateral and four terminal setæ. A finely setiferous lateral lamella is attached to the basal joint of each foot.

Giesbrecht's specimens were from the Pacific; so the known range of the species is now widely extended.

*Metridia princeps*, Giesbrecht. (Pl. VI. figs. 3, 4.)

1889. *Metridia princeps*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 24.

Three specimens of this large and well-marked species were found—one, fortunately a male, hitherto unknown, at 1410 fathoms, and two females at 1610 fathoms. The important differences between the sexes, as with the last species, are in the anterior antennæ and the fifth pair of swimming-feet.

*Male* (fig. 3).—Length 6.50 millim. The right antenna



is 25-jointed, that of the left 22. The comparative lengths of the joints of the latter are about as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
9	2	2	3	2	3	2	2	3	3	3	5	6	7	8	6	6	13	6	8	5	2*

The geniculation in the left antenna is between the seventeenth and eighteenth joints. Fifth pair of swimming-feet (fig. 4) each a single branch with four joints, the terminal joints being long, stout, blunt spines, with a minute spine at the end of each.

Much less perceptibly than in *M. venusta*, the right caudal segment is shorter than the left.

Giesbrecht's previous records of this species are the Pacific Ocean and the Gulf of Gascogne, so its range also is much extended.

*Pleuromamma abdominalis*, Lubbock.

1856. *Diaptomus* (part.), Lubbock, Tr. Ent. Soc. vol. iv. p. 22.

Very common throughout the collection, occurring at twenty-seven stations at depths from 270 to 1770 fathoms. Easily recognized by its round lateral black pigment knob.

*Pleuromamma gracilis*, Claus.

1863. *Pleuromma gracile*, Claus, Freileb. Cop. p. 197.

A rare species, though widely distributed throughout the world. One specimen only was found, at a depth of 1570 fathoms.

*Lucicutia longicornis*, Giesbrecht.

1889. *Leuckartia longicornis*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 812.

One specimen was found at a depth of 1070 fathoms. The only previous record of this species is the Pacific Ocean.

*Lucicutia flavicornis*, Claus.

1863. *Leuckartia flavicornis*, Claus, Freileb. Cop. p. 186.

A widely distributed ocean species. Occurred at ten stations at depths from 810 to 1770 fathoms.

*Lucicutia longiserrata*, Giesbrecht.

1889. *Leuckartia longiserrata*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 813.

One specimen was obtained at 1275 fathoms. Its only record hitherto is the Pacific Ocean.

*Lucicutia Clausi*, Giesbrecht.

1889. *Leuckartia Clausii*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 812.

A few specimens of this species were taken at 510 fathoms. Its previously known range is the Mediterranean and Pacific Ocean.

*Isochæta longisetosus*, sp. n. (Pl. VII. figs. 1-9.)

*Female*.—Length 3.50 millim. Cephalothorax has five segments. Rostrum appears to consist of two long, narrow, ribbon-like bodies. Anterior antennæ 23-jointed, the relative lengths being much as follows:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
6	2	3	2	2	2	2	2	2	3	3	3	3	4	4	4	4	4	4	3	2	2	2

They are sparingly setiferous. Each antenna has a dark brown seta on last joint. The two branches of posterior antennæ (fig. 2) are of about equal length; the outer branch 8-jointed, the fourth to seventh joints being a compound joint; the eighth joint nearly as long as the other seven together. From the compound joint spring a number of flat ribbon-like hairs, which, like the apical hairs, appear to be filled with very minute round granules. The inner branch springs from the basal joint at right angles to the outer, and terminates with six or eight very long ribbon-like setæ, also dark brown and granular. Mandible (fig. 3) has a main branch of three joints, terminated by long, brown, flat setæ, as described above. Two small segments, each terminated by a long slender spine, spring from the middle joint; from the basal joint arises a short stout branch, ending with spinous setæ, which appear to take the place of any biting-teeth. Maxilla (fig. 4) consists of two small 2-jointed branches proceeding from a common base, their terminal joints ending in several of the long granular setæ as described above. Anterior foot-jaws (fig. 5) long and broad, with two long spines at apex of each of two protuberances on first joint. Three very small terminal joints are also provided with long curved spines. Posterior foot-jaws (fig. 6) 7-jointed, long spines springing from each; there are also several small spines on the third and fourth joints. Abdomen 4-jointed; the first joint is nearly twice the size of any of the others; caudal setæ without the dark granular coloration. Outer and inner branch of the swimming-feet (figs. 7 & 8) are all 3-jointed, with the exception of the fifth pair (fig. 9), the inner branch of which is 2-jointed.

One specimen only of this remarkable Copepod was taken at 560 fathoms.

The long, brown, ribbon-like, granular setæ on the anterior and posterior antennæ, as well as on the mandible and maxilla, and the peculiar shape of the posterior antennæ readily distinguish this species from any other known to me.

*Heterorhabdus spinifrons*, Claus.

1863. *Heterochæta spinifrons*, Claus, Freileb. Cop. p. 182.

One of the most widely distributed species throughout the collection, having been taken at fourteen stations in fair abundance at depths from 375 to 1770 fathoms. It has been reported from the Mediterranean and from both Atlantic and Pacific Oceans.

*Heterorhabdus papilliger*, Claus.

1863. *Heterochæta papilligera*, Claus, Freileb. Cop. p. 182.

One specimen only, found at 1510 fathoms. Not before reported from the Atlantic Ocean.

*Heterorhabdus abyssalis*, Giesbrecht.

1889. *Heterochæta abyssalis*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 812.

Several specimens, all males (the female being still unknown), were found at three stations at depths of from 950 to 1190 fathoms. Giesbrecht's record was the Atlantic, but at the great depth of 4000 metres.

*Heterorhabdus Clausi*, Giesbrecht.

1889. *Heterochæta Clausii*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 812.

Found at one station only at 1410 fathoms. Its only previous record was from the Pacific.

*Heterorhabdus vipera*, Giesbrecht.

1889. *Heterochæta vipera*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 812.

A few specimens occurred at two stations at depths of 950 and 1410 fathoms. The Atlantic and Pacific are its known range of distribution.

*Heterorhabdus longicornis*, Giesbrecht.

1889. *Heterochæta longicornis*, Giesbrecht.

One specimen only (a female) was found at 1710 fathoms.

Its very long slender antennæ, taken in conjunction with its still longer caudal setæ, easily distinguish it. The Atlantic and Pacific Oceans are its recorded habitats. The male remains unknown.

*Haloptilus longicornis*, Claus.

1863. *Hemicalanus longicornis*, Claus, Freileb. Cop. p. 179.

Fairly common at three stations at depths from 620 to 1770 fathoms. Recorded from the Atlantic and Pacific Oceans and the Mediterranean.

*Haloptilus ornatus*, Giesbrecht.

1892. *Hemicalanus ornatus*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 84.

Found at two stations at 810 and 1670 fathoms. Previously known only from the Mediterranean.

A strong hooked spine and plumose hairs from the other lobes of the anterior foot-jaws serve to distinguish this species.

*Haloptilus spiniceps*, Giesbrecht.

1892. *Hemicalanus spiniceps*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 384.

One specimen only from a depth of 500 fathoms was found. Its only previous record is the Mediterranean.

*Augaptilus filigerus*, Claus.

1863. *Hemicalanus filigerus*, Claus, Freileb. Cop. p. 179.

A few specimens of this species were found at two stations at depths of 1065 and 1270 fathoms. Like the last species, its only previous record is the Mediterranean.

*Augaptilus palumboi*, Giesbrecht. (Pl. I. figs. 1, 2.)

1889. *Augaptilus palumbii*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 813.

The only specimen found (fig. 1) was taken at 1070 fathoms, and fortunately proved to be a male, hitherto unknown.

The chief differences between the male and female are in the anterior antennæ and the fifth feet; the latter, however, in this specimen (fig. 2) are unfortunately immature. The right and left anterior antennæ vary considerably (fig. 1). The right is 14-jointed, the third, fourth, and fifth joints being short and swollen; the left is 19-jointed, the joints 2 to 6 being short and swollen. Waving setæ are numerous throughout the length of both antennæ. Length of male 4 millim.

Its only previous record is the Pacific Ocean.



*Augaptilus Rattrayi*, T. Scott.

1893. *Augaptilus Rattrayi*, T. Scott, Tr. Linn. Soc. ser. 2, Zool. vol. vi. p. 36.

One specimen only of this rare species, hitherto only known through Mr. Scott's excellent report on "Entomostraca from the Gulf of Guinea," was taken at 1070 fathoms. The short, crescent-shaped, flat-topped filaments which adorn the maxillæ and foot-jaws are quite diagnostic of this species.

*Augaptilus hecticus*, Giesbrecht.

1889. *Augaptilus hecticus*, Giesbrecht, Atti Acc. Lincei Rend. ser. 4, vol. v. p. 814.

A single male of this species was found at 1275 fathoms. The elegant plumes near the extremity of the anterior antennæ and on the caudal setæ, as shown by Giesbrecht, were not present, probably lost. Previously known from the Mediterranean, Gulf of Guinea, and Pacific Ocean.

*Augaptilus longicaudatus*, Claus.

1863. *Hemicalanus longicaudatus*, Claus, Freileb. Cop. p. 129.

A few specimens were found at 1070 and 1670 fathoms.

This species is easily recognized by the flat-topped button-like filaments attached to the setæ of the foot-jaws, similar to those of *A. Rattrayi*, which, as before referred to, are crescent-shaped.

Its hitherto known areas of distribution are the Mediterranean, Gulf of Guinea, and Pacific Ocean.

*Arietellus setosus*, Giesbrecht.

1892. *Arietellus setosus*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 415.

A male and female of this very handsome species were taken at 500 and 1300 fathoms respectively. The beautiful yellow coloured plumose caudal setæ at once distinguish both sexes. The Mediterranean and Gulf of Guinea are its hitherto known range.

*Phyllopus bidentatus*, Brady. (Pl. III. figs. 6-9.)

1883. *Phyllopus bidentatus*, Brady, Rep. Voy. Chall. vol. viii. p. 78.

This species is known only from three specimens—first, a female described by Brady from the 'Challenger' Expedition taken down to 2650 fathoms in the South Atlantic; the second, also a female, by Giesbrecht at 1800 metres, from the Pacific; and now the third, a male from the North Atlantic at 560 fathoms, in the present 'Oceana' collection.

The general agreement of my specimen with Giesbrecht's description and drawings clearly demonstrates it to be *P. bidentatus*. The differing characters of the male are as under. Brady supposed his specimen to be a male, but, as Giesbrecht points out, it certainly is a female. The latter authority failed to find the "stout bidentate process" as described by Brady as existing, produced ventrally, on the last thoracic segment. My specimen certainly has this process, though not so pronounced as in Brady's drawings, and only on the right side. The left side termination, however, is not clearly defined, so the "process" may have been lost. Length 2.75 millim. (fig. 6). Right anterior antenna (fig. 2) 24-jointed, the left (fig. 3) 20-jointed, the latter having a geniculation between the sixteenth and seventeenth joints. In the right the joints after the twelfth are less than half the width of the previous ones. The relative lengths of the joints are in about the following proportions:—

## Right.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
16	4	4	6	4	4	4	3	3	3	3	3	4	6	8	10	12	14	16	12	10	10	12	

## Left.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
20	6	6	6	6	6	3	4	3	3	4	4	8	12	14	12	12	16	14	12

The fifth pair of swimming-feet (fig. 4) consists of two branches, each 3-jointed, with one common basal joint. A lamellated process projects from the inner side of the first joint on the right, and a smaller one from the inner side of the second joint on the left. The terminal joint of the right consists of a strongly muscular chelate organ, that of the left being rather smaller and apically obtuse and also very muscular.

*Anomalocera Patersoni*, Templeton.

1837. *Anomalocera Patersonii*, Templeton, Tr. Ent. Soc. vol. ii. p. 34.

It was rather surprising to find only one specimen of this large brilliantly coloured species, well known as occurring often in dense shoals round our coasts, and known also in the Mediterranean and in the Atlantic and Pacific Oceans. It was taken by the surface-net.

*Acartia Clausi*, Giesbrecht.

1863. *Dias longiremis* (part.), Claus, Freileb. Cop. p. 193.

One of our commonest British species. Well known in

the Mediterranean and Atlantic Ocean, and reported from Puget Sound in the Pacific. It was found at fifteen stations in this collection, from the surface to 1670 fathoms. As only careful examination can readily determine this species from the next, *A. longiremis*, some not so examined may belong to the latter species.

*Acartia longiremis*, Lillj.

1853. *Dias longiremis*, Lillj. Clad. Ostr. Cop. p. 181.

Considerably rarer than the last species, *A. Clausi*, being hitherto known only round our own coasts and in the Baltic and North Sea south of Greenland. The presence of a few small spines on the abdomen and a difference in the fifth pair of feet of this species constitute the chief difference between this species and the preceding, *A. Clausi*. They were formerly included as one species.

*Acartia discaudata*, Giesbrecht.

1881. *Dias discaudatus*, Giesbrecht, Zool. Anz. vol. iv. p. 257.

A few specimens were found at a depth of 374 fathoms. It differs from the last two species in appearance by its rounded short furcal segments. The Baltic, North Sea, and our own shores have been hitherto its recorded habitats.

*Acartia centrura*, Giesbrecht.

1889. *Acartia centrura*, Giesbrecht, Atti Acc. Lincei Rend. vol. v. p. 25.

One specimen of this rare species was taken at 810 fathoms. Its small terminal spines lateral to the cephalothorax easily distinguish it from the three preceding species. Its only previous record is the Red Sea.

*Mormonilla phasma*, Giesbrecht.

1891. *Mormonilla phasma*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 532.

One of the more common species of the collection, occurring at nine stations in fair quantity at depths from 810 to 1610 fathoms; and previously known only from a few specimens reported by Giesbrecht from the Pacific, and by T. Scott from the Gulf of Guinea. Its long, transparent, slender form and thin, 5-jointed, setose antennæ easily distinguish it from any other known species.

*Oithona similis*, Claus.

1863. *Oithona helgolandica*, Claus, Freileben Cop. p. 104.

One of the commonest species in the collection, occurring plentifully at twenty-eight stations at depths from the surface to 1710 fathoms. It is abundant throughout the northern seas, extending to the Mediterranean and the Canary Islands and Atlantic Ocean.

*Oithona nana*, Giesbrecht.

1892. *Oithona nana*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 549.

Only one specimen, from 1610 fathoms, was noticed, though, possessing no strong mark for recognition, others may have been passed over. Its blunt broad head is its distinctive feature.

*Thorellia brunnea*, Boeck.

1864. *Thorellia brunnea*, Boeck, Oversigt over de ved Norges Kyster iagt. Cop. p. 26.

A northern species occasionally found in British seas, but apparently not hitherto recorded further south. One specimen was found at 270 fathoms.

*Microsetella atlantica*, Brady & Robertson.

1873. *Microsetella atlantica*, Brady & Robertson, Ann. & Mag. Nat. Hist. ser. 4, vol. xii. p. 130.

Common throughout the collection, occurring at twenty-eight stations at depths from 270 to 1710 fathoms. It is common in our own seas, and T. Scott reports it as plentiful about the Gulf of Guinea.

*Microsetella rosea*, Dana.

1847. *Canthocamptus roseus*, Dana, Proc. Amer. Acad. Boston, vol. i. p. 150.

Although not so widely distributed throughout the collection as the preceding species, it was plentiful at seventeen stations. Dana reported it from the Sulu Sea, Giesbrecht found it in the Eastern Pacific, and T. Scott in the Gulf of Guinea.

*Euterpe acutifrons*, Dana.

1847. *Euterpe acutifrons*, Dana, Proc. Amer. Acad. Boston, vol. i. p. 150.

One specimen of this species, not uncommon round our British shores, was taken at 950 fathoms. Dana's habitat



was Rio Negro, and it has been reported from the Mediterranean, North Sea, Canary Islands, &c.; so it has a widely distributed range.

*Setella gracilis*, Dana.

1852. *Setella gracilis*, Dana, Crust. U.S. Expl. Exped. p. 1198, pl. lxxxv.

This well-defined species occurred plentifully in two gatherings, taken at 1065 and 1670 fathoms respectively.

*Delavalia palustris*, Brady.

1868. *Delavalia palustris*, Brady, Tr. Nat. Hist. Soc. Northumberland and Durham, vol. iii. p. 134.

A fairly common species round our coasts in shallow rock-pools, but seemingly out of place in this collection! A single specimen was found at 1070 fathoms.

*Clytemnestra scutellata*, Dana.

1847. *Clytemnestra scutellata*, Dana, Proc. Amer. Acad. Boston, vol. i. p. 150.

The only specimen found was at 950 fathoms. This species has a wide range. Dana obtained it in the China Sea, Poppe in the Java Sea, and I have found it near Malta in the Mediterranean.

*Ægisthus mucronatus*, Giesbrecht.

1891. *Ægisthus mucronatus*, Giesbrecht, F. Fl. Neapel, Cop. vol. xix. p. 573.

Several specimens of this species were obtained from eight stations at depths of from 375 to 1570 fathoms. One specimen was found by Giesbrecht in the Pacific Ocean near the Galapagos Islands. T. Scott, in his excellent monograph "Entomostraca from the Gulf of Guinea," describes his *Æ. longirostris*, which, from his description and drawings, I believe to be *Æ. mucronatus*, Giesbrecht (the species before us). Scott says "they do not agree with *Æ. aculeatus*, Giesbrecht," but he appears to have overlooked *Æ. mucronatus*! Its long pointed rostrum is very diagnostic.

*Ægisthus aculeatus*, Giesbrecht.

1891. *Ægisthus aculeatus*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 572.

Evidently much less common in the district traversed for this collection, one specimen only having been obtained. Giesbrecht's two specimens were taken along with *Æ. mucronatus*, from which the present species is easily distinguished by its small sharp rostrum.

*Oncaea mediterranea*, Claus.

1863. *Antaria mediterranea*, Claus, Die freileb. Cop. p. 159.

This appears to be a common and widely distributed species, its range extending from Spitzbergen to the Mediterranean, and to the Atlantic and Pacific Oceans. It occurred at fifteen stations in fair quantity at depths from 500 to 1710 fathoms. It is brilliantly coloured during life.

*Oncaea minuta*, Giesbrecht.

1892. *Oncaea minuta*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 591.

Much rarer than the last species. It occurred at three stations at depths from 610 to 1275 fathoms. Its small size is a distinguishing feature. The male appears to be unknown.

*Concaea rapax*, Giesbrecht.

1891. *Concaea rapax*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 605.

A common species throughout the collection, occurring at twenty-eight stations. Giesbrecht found a few specimens in the Pacific, west of the Galapagos Islands; but I do not find other records. Its known range is therefore now widely extended.

*Sapphirina salpæ*, Claus.

1849. *Sapphirina iris*, Dana, Proc. Amer. Acad. Boston, vol. ii. p. 8.

One specimen only of this species, and the only specimen of the large genus *Sapphirina*, was taken at 810 fathoms. Its known range extends over the Mediterranean and the Atlantic and Pacific Oceans.

*Lichomolgus liber*, Brady & Robertson.

1875. *Lichomolgus liber*, Brady & Robertson, Brit. Assoc. Rep. 1875, p. 197.

One specimen, probably a stray one, was found at 270 fathoms. I am not aware that it has been previously reported outside our British coasts.

*Corina granulosa*, Giesbrecht.

1891. *Corina granulosa*, Giesbrecht, F. Fl. Neapel, vol. xix. p. 645.

A rare species, closely allied to the genus *Corycæus*, but differing in its abdominal segments. Only one specimen (a female) occurred, at 500 fathoms. Giesbrecht also had only one specimen (also a female). His was from the South Pacific, mine from the Atlantic.

*Corycæus venustus*, Dana.

1849. *Corycæus venustus*, Dana, Proc. Amer. Acad. Boston, vol. ii. p. 8.

A few specimens of this species were found at three stations, extending in depth from the surface to 650 fathoms. Dana's habitat was Kingsmill Island, Brady obtained it in the South Atlantic, and I have found it in the Mediterranean and about the Canary Islands.

*Corycæus anglicus*, Lubbock.

1857. *Corycæus anglicus*, Lubbock, Ann. & Mag. Nat. Hist. vol. xx. p. 401.

One of the smallest in size of the genus. Hitherto chiefly known from Heligoland and about the western coasts of Britain. It occurs at three stations in this collection at from 270 to 374 fathoms. I have found it plentiful at times about the surface off the south-west of Ireland.

EXPLANATION OF THE PLATES.

PLATE I.

*Augaptilus palumboi*, Giesbrecht.

Fig. 1. Male.

Fig. 2. Fifth pair of feet of immature male.

*Gaëtanus miles*, Giesbrecht.

Fig. 3. Posterior foot-jaw of male.

Fig. 4. Last joint of cephalothorax, and abdomen with caudal appendages of male.

Fig. 5. Fifth pair of feet of immature male.

*Spinocalanus abyssalis*, Giesbrecht.

Fig. 6. Fifth pair of feet of immature male.

*Gaidius pungens*, Giesbrecht.

Fig. 7. Fifth pair of feet of immature male.

PLATE II.

*Euchæta oceana*, sp. n.

Fig. 1. Male, dorsal view.

Fig. 2. Third to sixth joints of anterior antennæ, showing papillæ.

Fig. 3. Posterior antenna.

Fig. 4. Maxilla.

Fig. 5. Mandible.

Fig. 6. Posterior foot-jaw.

Fig. 7. Foot of first pair.

Fig. 8. Fourth pair of feet.

Fig. 9. Fifth pair of feet.

PLATE III.

- Fig. 1. Scolecithrix cristata*, Giesbrecht. Male.  
*Fig. 2.* Anterior antenna.  
*Fig. 3.* Posterior antenna.  
*Fig. 4.* Fifth pair of feet.  
*Fig. 5.* Termination of one of the fifth feet, highly magnified.  
*Fig. 6. Phyllopus bidentatus*. Male.  
*Fig. 7.* Anterior antenna, right.  
*Fig. 8.* Anterior antenna, left.  
*Fig. 9.* Fifth pair of feet.

PLATE IV.

- Fig. 1. Xanthocalanus Giesbrechti*, sp. n. Female.  
*Fig. 2.* Anterior antenna.  
*Fig. 3.* Posterior antenna.  
*Fig. 4.* Mandible.  
*Fig. 5.* Maxilla.  
*Fig. 6.* Anterior foot-jaw.  
*Fig. 7.* Posterior foot-jaw.  
*Fig. 8.* Second pair of feet.  
*Fig. 9.* Fifth pair of feet.

PLATE V.

- Fig. 1. Scolecithrix chelifer*, sp. n. Male.  
*Fig. 2.* Anterior antenna.  
*Fig. 3.* Posterior antenna.  
*Fig. 4.* Mandible.  
*Fig. 5.* Anterior foot-jaw.  
*Fig. 6.* Posterior foot-jaw.  
*Fig. 7.* Second pair of feet.  
*Fig. 8.* Terminal spine of ditto.  
*Fig. 9.* Fifth pair of feet, immature.

PLATE VI.

- Fig. 1. Metridia venusta*, Giesbrecht. Male.  
*Fig. 2.* Fifth pair of feet.  
*Fig. 3. Metridia princeps*, Giesbrecht. Male.  
*Fig. 4.* Fifth pair of feet.

PLATE VII.

- Fig. 1. Isochæta longisetosus*, sp. n. Female.  
*Fig. 2.* Posterior antenna.  
*Fig. 3.* Mandible.  
*Fig. 4.* Maxilla.  
*Fig. 5.* Anterior foot-jaw.  
*Fig. 6.* Posterior foot-jaw.  
*Fig. 7.* Fourth pair of feet.  
*Fig. 8.* Terminal spine of same.  
*Fig. 9.* Fifth pair of feet.



II.—On a Collection of Fishes from the Cameroon containing new Species. By Dr. EINAR LÖNNBERG, C.M.Z.S. &c.

SOME time ago I received from my friend Mr. Gunnar Linnell a collection of freshwater fishes brought together from three different localities of the Cameroon territory, viz.:—

1. The river at *Sanye* (also spelt *Sunyi*), not far from the sea, but above the influence of the salt water.

2. *Meme River*, far inland.

3. *Elephant Lake* at the station Johann Albrechtshöhe.

This collection is not large, but as it contains several species new to the territory and also some quite new to science I venture to describe it here.

*Isichthys Henryi*, Gill.

Four specimens from the river at Sanye, the largest about 200 millim. Although known from Liberia to Mayumba, French Congo\*, this species does not seem to have been recorded from the Cameroons before.

*Marcusenius brachyhistiis*, Gill.

A single specimen from the river at Sanye.

*Alestes nurse* (Rüppell).

Dorsal originating above ventrals. Sq. 25–26  $\frac{5}{3}$  1.

A. 15–16. D. 10.

Height of body  $3\frac{1}{5}$ – $3\frac{1}{8}$  times in total length †. Length of head nearly 4 times in total length. Head longer than high. Snout longer than eye. Eye  $3\frac{2}{3}$  in length of head. Interorbital space  $2\frac{1}{5}$ – $2\frac{1}{4}$  in length of head. Adipose eyelids present. Mouth broader than eye, but the posterior end of maxillary well in front of the vertical through the anterior border of the eye. Height of caudal peduncle about  $\frac{2}{3}$  of its length.

There are 16 teeth in the upper jaw, arranged as follows:—8 form an inner continuous series; the 8 outer ones are remote from each other, and 6 are placed just at the outer margin of the jaw, viz. the 2 most median and the 2 most lateral

\* See Boulenger, "Revision of the Genera and Species of Fishes of the Family Mormyridæ," Proc. Zool. Soc. London, 1898.

† Without caudal.

or posterior on either side, the remaining 2 being situated a little further inwards in the interspace between the median and lateral pairs. The 8 outer teeth are tricuspid, the 8 inner of the uninterrupted series are much larger. Each tooth of the latter series has two transverse rows of cusps, the outer usually consisting of two cusps and the inner of three or more. The cusps of the inner row are larger, especially the middle one. All teeth are brownish. There are 8 pluri- (5-7-) cuspid teeth in an uninterrupted series in the lower jaw, and behind these a pair of conical fangs. The fangs are less brown than the large middle cusps of the pluricuspid mandibular teeth.

The second infraorbital is longer than the diameter of the eye. The pectorals are longer than the ventrals.

The tips of the pectorals are about as far from the base of the ventrals as the tips of the latter are from the anus—that is, about  $1\frac{1}{2}$  centim. in the largest specimens. The distance between the base of the pectorals and the snout is about half of the measurement expressing the distance between the snout and the base of ventrals. The caudal is deeply cleft, the outer rays being more than twice as long as the middle ones, or, in other words, the latter being only  $\frac{2}{3}$  of the former.

The colour of the preserved fishes seems to indicate that the colour of the living fish may have been brownish olive above and golden or silvery below. There might have been a dusky longitudinal band along the third row of scales counted from above; but I am very uncertain about this, as it is most conspicuous in such places where the scales are lost, but hardly visible where the scales remain. A black blotch situated on the body behind the opercle on a level with the eye, and on a vertical line drawn between the first and second third of the pectoral, is well visible on all specimens. Caudal fin reddish orange, perhaps with dusky border. Outer half of dorsal reddish orange, its basal half probably dusky.

Five specimens, measuring from 178 to 210 millim. in length, from the Meme River, far inland.

I am unable to find any features by which this fish could be distinguished from Rüppell's species as it is described in the literature. It thus appears to be widely distributed, as it is known from the Nile, Lake Victoria, Lake Rudolf, Senegal, Gambia, and Niger, but hitherto not from the Cameroon.

*Nannæthiops unitæniatus*, Gthr.

A specimen measuring 44 millim. in total length and

another strongly mutilated, both from Meme River, far inland.

This species does not appear to have been previously known from the Cameroons, although recorded from Gaboon, the Gold Coast, and Ubangi.

*Clarias bythipogon*, Sauvage.

Three specimens from the river at Sanye, the largest measuring nearly 30 centim. in total length. It may thus be the largest known specimen of its kind. In his work 'Les Poissons du Bassin du Congo' Boulenger has recorded 23 centim.

*Auchenoglanis guttatus* (Lönnberg).

A specimen from the Meme River, far inland.

*Malopterurus electricus* (Gmelin).

Several specimens from Sanye and the Meme River.

*Haplochilus infrafasciatus*, Günther.

Three specimens from the river at Sanye.

*Ophiocephalus obscurus*, Günther.

A specimen from the Meme River.

*Eleotris Büttikoferi*, Steindachner.

A young specimen from the Meme River most probably belongs to this species.

*Pelmatochromis Boulengeri*, sp. n.\*

Three (or four) inner series of small and an outer series of larger teeth. Depth of body  $2\frac{1}{2}$  to  $3\frac{2}{5}$  times in total length. Length of head  $2\frac{1}{2}$  to  $2\frac{2}{3}$  times in total length. Snout broad, rounded, with straight profile much longer than eye, which is contained about  $2\frac{1}{3}$  times in length of snout and  $4\frac{2}{3}$  times in length of head, and nearly  $1\frac{1}{2}$  ( $\frac{9}{13}$ ) times in interorbital width. Maxillary reaching about halfway between nostril and anterior border of eye. Four or five series of scales on the cheek; large scales on the opercle. Gill-rakers short. Dorsal XVI 10-11; spines increasing to the last, which measures  $\frac{3}{4}$  to  $\frac{2}{5}$  of the length of head. Pectoral about  $\frac{3}{4}$

\* I take the liberty of dedicating this new species to Mr. G. A. Boulenger, who has done more than anybody else to increase our knowledge of the West-African fishes.

length of head. Filamentous prolongation of ventral reaching beyond anus, but not quite to origin of anal. Anal III 7-8; third anal spine shorter, but stouter, than last dorsal. Caudal rounded. Caudal peduncle deeper than long. Scales smooth, 25 in a longitudinal series; transverse series  $\frac{3}{10}$  1. Upper lateral line 20, lower lat. line 8-10. On the smallest specimen, about 130 millim., four dusky transverse bars may be traced. All specimens have a black opercular spot near the upper end of the hind margin of the opercle. It seems as if the anal had been longitudinally banded with a distal and a basal darker band and a lighter (coloured?) one between.

Three adult specimens from the Meme River, far inland, the largest 140 millim.

In three young specimens, measuring from 47 to 63 millim. in total length, the height of body equals the length of head, and both are contained  $2\frac{2}{3}$  times in the length of head and body without caudal; but the eyes are, as usual in young fishes, comparatively larger, and are only contained 3 times in length of head, and the diameter of the eye is  $\frac{6}{7}$  of the length of snout.

In a seventh specimen, of intermediate size (80 millim.), the relative dimensions have approached those of the adult, the eye being contained  $3\frac{1}{2}$  times in length of head and about  $1\frac{2}{3}$  in length of snout.

This species is no doubt most nearly related to *Pelmatochromis Batesii*, Boulenger\*, from the French Congo, but differs from that species in its relative dimensions, among other things in its longer head, longer snout, smaller eye, one spine more in the dorsal, shorter anal spines, fewer scales, and (no doubt) different coloration.

In the following table some comparative measurements of different stages of development of this fish are given:—

Total length without caudal fin . . .	47 mm.	63 mm.	103 mm.	110 mm.
Length of head in % of total length.	38.3	38.0	38.8	38.1
Depth of body . . . . .	38.3	38.0	42.7	41.8
Distance from snout to anal fin . . .	69.1	71.4	72.8	71.8
"                    "          ventral fin. . .	40.4	41.2	43.6	42.7
Length of "ventrals . . . . .	27.6	30.1	28.1	30.0
"    pectorals . . . . .	31.9	28.5	28.1	29.0
Depth of caudal peduncle . . . . .	17.0	15.9	16.0	15.4
Length of "          " . . . . .	14.8	11.9	11.1	11.3
Diameter of eye in % of length of head . . . . .	33.3	29.1	23.7	22.6
Length of snout . . . . .	41.6	43.8	52.5	50
Interorbital breadth . . . . .	27.7	29.1	32.5	30.9

\* Ann. & Mag. Nat. Hist. (7) vol. viii. (1901).



From these measurements it will be seen that the relation between head and body is almost the same, but the height of body increases with age, which causes the distance from the snout to anal and ventral fins to be comparatively larger in the older specimens. The diameter of the eye compared with the length of head decreases a good deal, but the snout is enlarged with age\*.

*Tilapia lata*, Gthr., var. *camerunensis*, nov.

A specimen from Meme River resembles *T. lata* in almost every respect except that it has a smaller number of scales, so that only twenty-six can be counted in a longitudinal series. In this respect it resembles *T. Rangii*, Duméril, but differs on the other hand from that species in having shorter pectorals, which do not extend even to the vertical through the origin of the anal, still less beyond the same; but the pectoral is decidedly longer than the head. There are XVI dorsal spines and 12 soft rays. At the commencement of the soft dorsal there is, as in *T. lata*, a large black spot, and behind it three blackish streaks which are nearly vertical, but above the spot they curve forward and then become more longitudinal. There is a black spot near the upper end of the posterior margin of the opercle, and this is almost continued into a larger, less conspicuous, dark blotch extending downwards on the opercle. Four dusky transverse bands may be traced across the body. In other respects it agrees with the descriptions of *T. lata*†.

The specimen measures 128 millim. It was caught high up in the Meme River.

This form seems to be intermediate between *T. lata* and *T. Rangii*; whether it deserves specific rank or not I am unable to decide on only one specimen.

*Tilapia microcephala*, Bleeker.

Sq. 27  $\frac{3}{11}$  1. Lat. lin. sup. 21; lat. lin. inf. 10–11.

D. XVI 13. A. III 11.

Height of body contained fully twice in the total length

\* Since the above was in print Mr. G. A. Boulenger has described another apparently nearly related species from the Niger Delta (Proc. Zool. Soc. for Nov. 18, 1902) under the name *P. Pellegrini*. The latter differs in having a larger number of scales (28–29) and a different coloration, besides some other differences in the relative proportions, &c.

† *Conf.* Boulenger, "A Rev. of the Afr. and Syr. Fishes of the Fam. Cichlidæ," Proc. Zool. Soc. 1899.

(without caudal). Length of head contained as nearly as can be three times in total length. Diameter of eye about two thirds the length of the snout. Interorbital space as broad as the snout is long. Diameter of eye contained nearly four times in length of head. Nineteen gill-rakers on lower part of anterior arch.

The body is high and broad and the outline of the forehead forms an even but steep curve from the origin of the dorsal to the snout.

*Tilapia (Gephyrochromis) Linnellii*, sp. n.

Length of head longer than greatest depth of body; the former is contained about  $2\frac{2}{7}$  times in total length (without caudal), or represents 41.4 % of the latter measurement in the female (?); but in the male (?) the length of head is contained about  $2\frac{2}{7}$  times in total length, or represents more exactly 43.2 % of the latter. Greatest depth of body is in the female (?) contained about  $2\frac{3}{4}$  times in total length, or represents 36.3 % of that measurement, while in the male (?) the corresponding figures are about  $2\frac{2}{3}$ , or 37.3 %. This greatest depth is found at the occiput, and the depth at the origin of dorsal is about 2 millim. less. Snout and forehead are very broad, and the profile slopes in an almost straight line from occiput to end of snout. Diameter of eye is contained fully twice (male) or a little more (female) in length of snout and about five times in length of head. Interorbital space not quite so broad as length of snout, but twice as broad as diameter of eye in the female, not fully that in the male. Maxillary extending about midway between nostril and eye. About 100 long, conical, slightly curved teeth form the outer comb-like series in the upper jaw, and inside of this is a rather broad band of tricuspid teeth\*. All teeth have brown points. Two series of large scales on the cheeks, still larger scales on the opercle. Sixteen short gill-rakers on lower part of anterior arch. Dorsal XV 12-13; last spine longest, which does not, however, equal a third (usually  $\frac{2}{7}$ ) of the length of head, but about two thirds of longest soft ray. Pectoral measuring about  $\frac{5}{6}$  of length of head and reaching beyond origin of anal. The filamentous prolongation of ventral is rather short, not reaching anus. Anal III 9-10; third spine longest, about equal to longest dorsal. Caudal squarely truncate. Caudal peduncle about

\* Although these teeth are quite plainly tricuspid, the lateral points are not so sharp as those figured by Boulenger (Trans. Zool. Soc. London, vol. xvi., 1901) from *Gephyrochromis Moorii*.

as long as deep. Scales 27-28  $\frac{3}{13-14}$  1; lat. lin. sup. 17-20; lat. lin. inf. 12-13. Peritoneum black.

The coloration appears to have been rather dark, but more or less so in different specimens. It seems, however, probable that the back and upper parts have been blackish, perhaps bluish black. In the specimens I take to be males the lower jaw, branchiostegal and jugular portions, ventrals and anal, as well as the tract between those fins, seems to have been (bluish) black. In those which I think are females the jugular portion appears to have been orange, the ventrals being not black, but only dusky, and only the basal half of the anal being black. The pectorals seem to have been light-coloured in all specimens. The upper end of the hind margin of the opercle is bordered with black in all specimens.

The number of specimens is eight, and their length (with caudal) varies between 180 and 200 millim.

The dentition of all these specimens is perfectly identical and of the same type as that of the fish from Lake Tanganyika on which Boulenger established the genus *Gephyrochromis* \*. When examined with the aid of the keys elaborated by Boulenger †, the fish from the Elephant Lake must be referred to the genus *Gephyrochromis*. It happens, however, now and then that members of the genus *Tilapia* vary with regard to their dentition in such a way that they exhibit an outer series of simple conical teeth. Sauvage has remarked this about *T. Desfontainesi*, Lacép., and in his valuable book on the Congo fishes Boulenger † observes concerning *T. microlepis* (also from Lake Tanganyika) that the lateral cusp of the enlarged anterior teeth is very small and sometimes absent. Certain specimens even approached *Paratilapia* so nearly "that they could have been referred to that genus, if one did not know that their teeth were bicuspid in a more youthful stage." A similar change may take place during the development and growth of this species as well, because, although in all specimens on hand the outer teeth have the same general shape, there may on some few of these teeth of the youngest specimen be found some slight traces of a lateral cusp. In these circumstances the characteristic that should distinguish *Gephyrochromis* from *Tilapia* loses considerably in importance, and it seems almost necessary to withdraw the genus *Gephyrochromis* unless other characters besides the dentition are found to separate it from *Tilapia*. Mr. G. A. Boulenger has kindly told me that he is of

\* Ann. & Mag. Nat. Hist. ser. 7, vol. vii.; Trans. Zool. Soc. London, vol. xvi. pt. 3, p. 156, pl. xx.

† 'Poissons du Congo,' Bruxelles, 1901.

the same opinion. There is, however, another possibility, namely, to regard *Gephyrochromis* as a subgenus of *Tilapia* and unite under the former name such species of *Tilapia* which, when fully adult, acquire an outer enlarged series of simple, unicuspid, conical teeth. I am uncertain, however, if this would be suitable, because the development of such teeth instead of the bicuspid *Tilapia*-teeth is no doubt an adaptation to a certain kind of diet\* that could have taken place quite independently several times, and in species of *Tilapia* of a rather remote kinship. If this is the case, a subgenus *Gephyrochromis* would include a number of fishes similar in consequence of a parallel adaptive development, but without close genetic affinity, and that would, of course, be unsatisfactory. For want of material I cannot express any certain opinion, but must leave the question open for the present.

The genus *Gephyrochromis*, hitherto monotypic, was originally established on a fish discovered by Mr. J. E. S. Moore, and named after him *G. Moorii*. The fish from the Elephant Lake, Cameroon, fully agrees with regard to the dentition on which the generic diagnosis was founded, but differs in other respects a good deal from the first-mentioned type. The Cameroon fish has a larger head, longer snout, smaller eye, smaller number of dorsal spines, but larger number of soft rays, as well in dorsal as anal fins, and smaller number of scales in a longitudinal series. The general outline of the two species is also different. Among the true *Tilapia* the fish from the Elephant Lake most nearly approaches *Tilapia macrocephala*. In addition to the distinguishing characteristic deduced from the dentition the following differences may be enumerated:—*Tilapia* (*Gephyrochromis*) *Linnellii* has a larger head, the length of which is much longer than the depth of the body, while in *T. macrocephala* the opposite is the case. The snout of *T. Linnellii* is longer when compared with the diameter of the eye, which latter, even in my youngest specimen, is contained fully twice in the former, but in *T. macrocephala* not more than  $1\frac{1}{2}$  times. The eye of the former is smaller, even in the youngest contained 5 times in the length of the head, but only "4 to  $4\frac{1}{2}$ " in *T. macrocephala*. The interorbital breadth of *T. Linnellii* is also somewhat larger. Its last dorsal spine is the longest, but comparatively much shorter than in *T. macrocephala*. In the latter it is said to be 40 % ( $=\frac{2}{5}$ ) of the length of the head, but in the former it varies between 27·5 and 30 % of the

\* Probably more carnivorous than that of other species of *Tilapia*.



same measurement. The pectoral of *T. macrocephala* is decidedly longer than the head, but in *T. Linnellii* a good deal shorter than the head. On the other hand, the ventrals are shorter in the latter, not reaching the anus.

*Tilapia (Gephyrochromis) Linnellii* seems accordingly to be quite a distinct species. To allow further comparison I append a table of comparative measurements of two specimens (not the same as used for the diagnosis):—

Total length without caudal fin .....	163 mm.	147 mm.
Length of head in % of total length .....	44·7	42·8
Depth of body .....	38·0	38·7
Distance from snout to anal fin.....	74·8	74·8
"                    "          ventral fin.....	45·3	46·9
Length of " pectoral .....	36·1	36·0
"          ventral .....	22·7	24·4
Depth of caudal peduncle .....	13·8	14·2
Length of "          "          " .....	13·1	12·9
Diameter of eye in % of length of head .....	20·5	19·0
Length of snout .....	42·4	39·6
Interorbital breadth .....	35·6	39·6
Length of last dorsal spine .....	27·5	30·1

The specimens of *Tilapia (Gephyrochromis) Linnellii* were collected in the Elephant Lake, which is situated N.N.E. from the Cameroon Mountain, 9° 22' E. long., 4° 39' N. lat., and, according to Andrée's map of 1901, 320 m. above the sea. The Swedish civil engineer P. Dusén, who has visited this lake, puts its altitude above the sea-level at 285 m., and informs us that it is a typical crater-lake\*. It is now drained by a tributary to the Mungo River; the former finds its way from the lake through the narrow Barombi cleft. In former times, however, Mr. Dusén thinks that the lake was drained through a now dry river-bed to the Meme River. The distance between the Elephant Lake and the sea along the Mungo River and its tributary is probably about 90 or 100 kilometres. In such a case this crater-lake seems to be rather isolated, and its fauna must be of great interest from a zoogeographical point of view.

In addition to the fishes described above, Mr. G. Linnell has sent me some Crustacea from the Elephant Lake, namely, *Potamonautes africanus* (A. Milne-Edw.) and *Palaemon (Bithynis) jamaicensis Vollenhoveni* (Herklots). Both species were represented by very large and beautiful specimens, and seem consequently to flourish very well in the Elephant Lake.

\* Geol. Fören. Förh. no. 155, Bd. xvi. (Stockholm, 1894).

Although these animals are quite interesting, especially the shrimp, I am afraid that they are of little or no value for the explanation of the origin of the fauna of the Elephant Lake. Both species occur in other fresh waters \* in the Cameroons. The crab may easily ascend a river, although its water should run somewhat swiftly, and even cataracts might be avoided by them in walking on land. The shrimp may not have the same faculty, but my friend Professor Y. Sjöstedt, who, from his two years' stay in the Cameroons, is thoroughly acquainted with the prevailing conditions, has told me that the shrimps are much esteemed by the negroes, who catch and eat them, transporting them alive in baskets from one place to another. The possibility is therefore not excluded that the shrimps have been introduced into the Elephant Lake by the natives.

III.—*On the Hymenoptera collected by Mr. W. L. Distant in the Transvaal, South Africa, with Descriptions of supposed new Species.* By Lieut.-Colonel C. T. BINGHAM.

[Continued from vol. x. p. 222.]

Family Eumenidæ (cont.).

Genus ODYNERUS (cont.).

*Odynerus (Pterochilus) insignis*, Sauss.

*Pterochilus insignis*, Sauss. Etud. Fam. Vesp. iii. (1856) p. 324, pl. xv. fig. 12, ♀.

A single male without locality. Described originally from the Cape.

Genus SYNAGRIS, Latr.

*Synagris cornuta*, Linn.

*Vespa cornuta*, Linn. Syst. Nat. ed. xii. (1767) p. 951.

*Apis cornuta*, Drury, Illustr. Nat. Hist. ii. (1773) p. 88, pl. xlviii. fig. 3.

*Synagrus cornuta*, Latr. Hist. Nat. Crust. et Ins. iii. (1802) p. 360.

*Synagris cornuta*, Latr. Hist. Nat. Ins. xiii. (1805) p. 344.

One female, Isubu.

\* From the Meme River I received at the same time specimens of the same species of shrimp, although not so large, together with examples of *P. (B.) acanthurus* and *Olfersi*.

This species is included in the collection from the Transvaal, although the locality given (Isubu) is in West Africa.

*Synagris mirabilis*, Guér.

*Synagris mirabilis*, Guér., Lefebvre, Voy. Abyss. vi. (1848) p. 359, pl. viii. fig. 8; Sauss. Etud. Fam. Vesp. i. (1852) p. 82.

Seventeen females, nine males (typical), from Pretoria, Masil Nek, Rustenburg, and Durban (*Distant*), and Johannesburg (*A. Ross*). Five females and four males, Pretoria (*Distant*), with the apical white segments of the abdomen turning to red in certain lights.

*Synagris analis*, Sauss.

*Synagris analis*, Sauss. Etud. Fam. Vesp. i. (1852) p. 86.

Four females, Pretoria (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

*Synagris emarginata*, Sauss.

*Synagris (Hypagris) abdominalis*, Sauss.

Five females, Fort Johnston, Nyasaland (*Rendall*).

Family Vespidæ.

Genus *BELONOASTER*, Sauss.

*Belonogaster filiventris*, Sauss.

*Rhaphigaster filiventris*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 16, pl. ii. fig. 5.

*Belonogaster filiventris*, Smith, Cat. Hym. B. M. v. (1857) p. 194.

Sixteen workers, Pretoria and Waterval-onder (*Distant*); Barberton (*Rendall & Harrison*); Fort Johnston, Nyasaland (*Rendall*); Durban (*A. Ross*).

*Belonogaster grisea*, Fabr.

*Vespa grisea*, Fabr. Syst. Ent. (1775) p. 322; Oliv. Encycl. Méth., Ins. vi. (1791) p. 673.

*Vespa macilenta*, Fabr. Spec. Ins. i. (1781) p. 468; Guér. Linn. Syst. Nat. ed. xiii. (1790) p. 2754.

*Belonogaster rufipennis*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 235.

*Belonogaster griseus*, Smith, Cat. Hym. B. M. v. (1857) p. 94.

Twenty-one workers, Pretoria (*Distant*); Waterval-onder (*A. Ross*); Zomba (*Rendall*); Delagoa Bay (*Distant*); Fort Johnston, Nyasaland (*Rendall*); Brak Kloof, Cape Colony (*Mrs. White*).

*Belonogaster juncea*, Fabr.

*Vespa juncea*, Fabr. Spec. Ins. i. (1781) p. 468; Gmelin, Linn. Syst. Nat. ed. xiii. (1790) p. 2754.

*Rhaphigaster junceus*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 14, pl. ii. fig. 2.

*Belonogaster junceus*, Gerst. Pet. Reise n. Mossamb., Zool. v. (1862) p. 468; Magr. Ann. Mus. Civ. Gen. xxii. (1884) p. 599.

Twenty-one workers, Durban (*Ross & Distant*); Barberton (*Distant & Rendall*); Fort Johnston, Nyasaland (*Rendall*).

## Genus ICARIA, Sauss.

*Icaria clavata*, Sauss.

*Icaria clavata*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 40.

A solitary ♂ from Durban.

*Icaria cincta*, Lepel.

*Epipona cincta*, Lepel. Hist. Nat. Ins. Hym. i. (1836) p. 541.

*Icaria cincta*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 39, pl. v. fig. 9; Gerst. v. d. Decken's Reise in Ost-Afr. (1873) p. 324.

A solitary rather small specimen of var. A (*Saussure*) of the insect from Waterval-onder (*Distant*).

## Genus POLISTES, Latr.

*Polistes maculipennis*, Sauss.

*Polistes maculipennis*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 61, pl. vi. fig. 4.

Five workers, Fort Johnston, Nyasaland (*Rendall*).

*Polistes marginalis*, Fabr.

*Vespa marginalis*, Fabr. Syst. Ent. (1775) p. 367.

*Polistes marginalis*, Fabr. Syst. Piez. (1804) p. 272; Sauss. Etud. Fam. Vesp. ii. (1853) p. 62, pl. vi. fig. 2; Gerst. v. d. Decken's Reise in Ost-Afr. (1873) p. 325; Grib. Ann. Mus. Civ. Gen. xvi. (1881) p. 238.

*Polistes africana*, Pal. Beauv. Ins. Afr. et Amér. (1821) p. 207, Hym. pl. viii. fig. 4.

Eight workers, Pretoria (*Distant*); Zoutpansberg (*Kæssner*); Durban (*A. Ross*).

*Polistes Smithi*, Sauss.

*Polistes Smithi*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 60, pl. vii. fig. 3; Gerst. Peters's Reise n. Mossamb., Zool. v. (1862) p. 470; Grib. Ann. Mus. Civ. Gen. xxi. (1884) p. 287; Sauss. Grand. Hist. Madagasc. xx. pt. i. (1891) p. 146.

Three workers, Pretoria (*Distant*).



*Polistes fastidiosus*, Sauss.

*Polistes fastidiosus*, Sauss. Etud. Fam. Vesp. ii. (1853) p. 60; Gerst. Peters's Reise n. Mossamb., Zool. v. (1862) p. 470; Magr. Ann. Mus. Civ. Gen. xxi. (1884) p. 607.

Three workers from Cape Colony (Mrs. White & Schönland).

## Tribe ANTHOPHILA.

## Family Colletidæ.

## Genus PROSOPIS, Fabr.

*Prosopis pernix*, sp. n.

♀. Black; a broad vertical line on the clypeus, a spot at the base of each mandible, the orbits of the eyes anteriorly and posteriorly, broadly interrupted at the vertex, and a broad short transverse line on the scutellum yellow; pilosity reddish yellow, long and sparse except on the sides and front of the pronotum, where it is dense and forms a broad transverse streak; head in front closely punctured, the punctures shallow; the face round the base of the antennæ slightly concave, opaque; vertex, occiput, sides of the head behind the eyes, and thorax smooth, with a few scattered punctures; the cordate area at base of median segment above concave and minutely rugulose; legs polished, pilosity fairly abundant, dense on the posterior pair of tibiæ and on the tarsi, giving them a reddish appearance. Wings hyaline, slightly fuscous; nervures, stigma, and tegulæ brown. Abdomen slightly shining, covered somewhat thickly with small piligerous tubercles and punctures, the apical margins of the segments testaceous.

♂. Similar in sculpture, form, and pilosity, but the mandibles are entirely yellow; the vertical streak on the clypeus broadens and coalesces anteriorly with the yellow on the inner orbits; no transverse yellow streak on the scutellum.

Length, ♀ 8-10, ♂ 7; exp., ♀ 16-19, ♂ 14 millim.

*Hab.* Recorded from Durban (*A. Ross*).

Twelve females and two males. One specimen (a female) has the disk of the apical two abdominal segments red, but in sculpture and form is identical with the rest.

*Prosopis sandaracata*, sp. n.

♀. Black, the anterior four fifths of the clypeus, the posterior margin of the pronotum broadly, a spot beneath the

tegulæ, the basal half of the scutellum, and the apices of all the femora bright yellow; the tibiæ and tarsi of all the legs, the apical margins and sides broadly of the basal two, and the disks of the remaining abdominal segments red. Wings fusco-hyaline; nervures, stigma, and tegulæ brownish yellow. Head posteriorly, the thorax, legs, and apical three abdominal segments with yellowish-white pilosity, the hairs soft, rather curled, and long on the back of the head and the thorax, and short, stiff, rather oblique on the legs and abdomen; head and thorax smooth and shining, with a few scattered minute punctures; abdomen transversely finely rugulose, subopaque, not shining.

Length, ♀, 6; exp. 12 millim.

Male unknown.

*Hab.* Recorded from Durban (*A. Ross*).

Nearest to *P. purpurisata*, Vachal, from Algeria.

*Prosopis gracilis*, sp. n.

♀. Black, the clypeus with a T-shaped yellow mark, the lateral arms of the T very short, the down stroke very broad, the yellow not reaching the upper margin of the clypeus; head, thorax, and abdomen covered with a short, fairly dense, soft, dingy, white pilosity, longer and stiffer on the tibiæ and tarsi of the posterior legs; the apical four joints of the tarsi and the claws reddish yellow, entirely smooth, polished, and shining, with a few scattered minute punctures. Head with the front slightly concave. Thorax: the mesonotum convex, with three short, longitudinally impressed, parallel lines; cordate area at base of median segment broad, concave, and minutely rugulose within. Wings hyaline and iridescent; nervures, stigma, and tegulæ yellowish brown. Abdomen strongly depressed and attenuate at base, clavate posteriorly.

Length, ♀, 4.5; exp. 8.5 millim.

*Hab.* Recorded from Durban (*A. Ross*).

Family Apidæ.

Genus HALICTUS.

*Halictus jucundus*, Smith.

*Halictus jucundus*, Smith, Cat. Hym. B. M. i. (1853) p. 54; Sauss. Grandid. Hist. Madagasc. xx. (1893) p. 51.

Four females, Pretoria (*Distant*); Durban (*A. Ross*).

*Halictus albidus*, Lepel.

*Halictus albidus*, Lepel. Hist. Nat. Hym. ii. (1841) p. 281.

A solitary male from Pretoria (*Distant*) answering entirely to Lepeletier's description.

*Halictus terminalis*?, Smith.

*Halictus terminalis*, Smith, Cat. Hym. B. M. i. (1853) p. 54, ♀.

A single female from Durban (*A. Ross*).

I am somewhat doubtful about the identification of this. The specimen agrees with the type in the British Museum collection, but differs from Smith's description in having the antennæ entirely black, not "rufo-testaceous beneath," and the sides of the anal rima also black, not "bright ferruginous."

*Halictus communis*, Smith.

*Halictus communis*, Smith, Descr. New Spec. Hym. Brit. Mus. (1879) p. 33.

A solitary male, Pretoria (*Distant*).

Genus *NOMIA*, Latr.*Nomia tridentata*, Smith.

*Nomia tridentata*, Smith, Trans. Ent. Soc. (1875) p. 64.

Two males (typical) from Fort Johnston, Nyasaland (*Rendall*).

*Nomia armatula*, Dalla Torre.

*Nomia armata*, Smith (nec Oliv.), Trans. Ent. Soc. (1875) p. 67, pl. ii. fig. 14.

*Nomia armatula*, Dalla Torre, Cat. Hym. x. (1896) p. 164.

A single female, Pretoria (*Distant*).

Smith described and figured the posterior leg of the male. This insect, which I take to be the female of Smith's species, resembles the male (the type of which is in the British Museum collection) in size, colour, sculpture, and pubescence, differing only in the coxæ, femora, and tibiæ of the legs being entirely black, and only the basal *two* joints of the flagellum of the antennæ being fulvous beneath.

*Nomia crocisæformis*, sp. n.

♀. Black, the apical margins of the abdominal segments 1-4 with broad non-pubescent bands of bluish white above,

very widely interrupted in the middle; the whole head, the pronotum posteriorly, sides of the thorax and of the median segment, the outside of the tibiæ and tarsi of the four anterior legs, the femora, tibiæ, and tarsi of the posterior legs, and the apical two segments of the abdomen covered mostly with rather long snow-white pubescence, turning to rusty yellow on the apical margin of the clypeus and on the underside of the tarsi; on the apical two abdominal segments it is yellowish tipped with black. Head finely and rather closely punctured, from the front circular, with the inner orbits of the eyes convergent anteriorly; face rather flat, with a well-marked medial carina, distinct under the pubescence, running from the anterior ocellus to the base of the clypeus. Thorax and the basal halves of all the abdominal segments finely and closely punctured; mesonotum large, gently convex; scutellum transverse, rounded and convex above, with a somewhat spoon-shaped mucro on each side; postscutellum with a broad concave double mucro at base, projecting backwards and overhanging the rest of the postscutellum and the median segment. Wings fusco-hyaline, the posterior wings clear hyaline at base; nervures dark brown, black towards the base; tegulæ black. Legs black, the apical joint of the tarsi reddish brown. Abdomen massive; segments 1-4 with a deeply impressed transverse line, dividing each segment into an anterior and posterior portion, the posterior halves smooth or minutely rugulose.

♂. Very similar, differing only in having the femora of the posterior pair of legs incrassate, somewhat triangular in outline, and the tibiæ strongly flattened, broad, with the interior apical angle produced.

Length, ♀ 12, ♂ 13; exp., ♀ 25, ♂ 28 millim.

*Hab.* Two females from Fort Johnston, Nyasaland (*Rendall*); the male a solitary specimen in the British Museum collection from Abyssinia.

The bluish-white lateral markings on the abdomen and the dark fore with a hyaline hind wing give this insect a very *Crocisa*-like appearance. The neururation of the wings, the form of the clypeus and legs, however, are those of the genus *Nomia*.

*Nomia scitula*, sp. n.

♂. Black, the scape of the antennæ, the apical half of the femora, the tibiæ, and tarsi of the legs pale yellow; the flagellum of the antennæ red; the apical halves of the first to fifth abdominal segments yellowish or ivory white; the face with dense, the rest of the head, the thorax, and a fringe



along the apical margins of the abdominal segments with somewhat sparse yellowish-white pubescence; the head above, the thorax, and the basal halves of all the abdominal segments closely and not very finely punctured, opaque, the apical halves of the abdominal segments nearly smooth, very minutely transversely rugulose. Head from the front orbicular, the vertex rounded, transverse, and short; thorax short and massive; scutellum, postscutellum, and median segment roundly and steeply sloped, the postscutellum without a mucro. Wings hyaline, nervures and tegulæ reddish yellow. Legs: the femora of the posterior pair of legs immensely swollen, somewhat flat; the tibiæ very broad, with the inner angle at apex produced and acute. Abdomen massive, somewhat elongate and oval.

Length, ♂, 12; exp. 24 millim.

*Hab.* A single male from Fort Johnston, Nyasaland (*Rendall*).

*Nomia zonaria*, Walker (var.).

*Nomia zonaria*, Walk. List Hym. Egypt, 1871, p. 43.

Two males from Fort Johnston, Nyasaland (*Rendall*).

I am a little doubtful as to whether these are identical with Walker's insect, but they so closely resemble the type of *N. zonaria* in the British Museum that I prefer to consider them merely a variety of that species. They differ in having the inner angle of the enlarged and flattened tibiæ of the posterior pair of legs acutely but shortly produced, and not with a long curved spine.

*Nomia amænula*, Gerst.

*Nomia amænula*, Gerst. Arch. f. Naturg. xxxvii. i. (1870) p. 350, ♂; id. v. d. Decken's Reise in Ost-Afrika, Glied. (1873) p. 321, ♂, pl. xiii. fig. 11.

A male and a female from Waterval-onder (*Ross*).

Genus XYLOCOPA, Latr.

*Xylocopa caffra*, Linn.

*Apis caffra*, Linn. Syst. Nat. ed. xii. (1767) i. 2, p. 959, ♀.

*Apis olivacea*, Fabr. Mant. Ins. (1787) p. 300, ♂.

*Xylocopa caffra*, Latr. Hist. Nat. Crust. et Ins. xiv. (1805) p. 62;

Lepel. Hist. Nat. Hym. ii. (1841) p. 197; Smith, Trans. Ent. Soc.

1874, p. 258; Sauss. Grandid. Hist. Madagasc. xx. pt. i. (1891) p. 33.

*Xylocopa* (*Koptorthosoma*) *caffra*, Gribodo, Bull. Soc. Ent. Ital. xxvi. (1894) p. 272.

Nine females, three males, Fort Johnston, Nyasaland (*Rendall*).

*Xylocopa inconstans*, Smith.

*Xylocopa inconstans*, Smith, Trans. Ent. Soc. (1874) p. 264; Radoszk. Hor. Soc. Ent. Ross. xii. (1876) p. 128; Gribodo, Ann. Mus. Civ. Gen. xvi. (1881) p. 233; Magretti, Ann. Mus. Civ. Gen. (1884) p. 629.

Twelve females, Pretoria, Waterberg, Masil Nek (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

Mr. Distant notes, under date Pretoria, August 1896, "All procured from one old post." The specimens from Nyasaland have the pubescence on thorax posteriorly and basal segment of abdomen yellow, not white.

*Xylocopa olivacea*, Spin.

*Xylocopa olivacea* (Klug), Spin. Ann. Soc. Ent. Fr. vii. (1838) p. 519; Smith, Trans. Ent. Soc. (1874) p. 259; Gribodo, Ann. Mus. Civ. Gen. (1881) p. 231; Sauss. Grandid. Hist. Madagasc. xx. pt. i. (1891) p. 32. *Xylocopa luteola*, Lepel. Hist. Nat. Hym. ii. (1841) p. 199.

Three females, one male, Pretoria, Waterberg, Delagoa Bay (*Distant*). Sixteen females, Fort Johnston, Nyasaland (*Rendall*).

*Xylocopa hottentotta*, Smith.

*Xylocopa hottentotta*, Smith, Cat. Hym. Ins. Brit. Mus. ii. (1854) p. 349; id. Trans. Ent. Soc. 1874, p. 256; Gribodo, Ann. Mus. Civ. Gen. xxi. (1884) p. 350.

Five females, Durban (*Distant* & A. Ross).

*Xylocopa Sichelii*, Vach.

*Xylocopa Sichelii*, Vach. Ann. Soc. Ent. Fr. lxxvii. (1898) p. 92.

Two females, Pretoria (*Distant*); Barberton (*Rendall*).

*Xylocopa tarsata*, Smith.

*Xylocopa tarsata*, Smith, Cat. Hym. Ins. Brit. Mus. ii. (1854) p. 348; id. Trans. Ent. Soc. 1874, p. 265.

A solitary female from Pretoria (*Zutrzenka*).

*Xylocopa nigrita*, Fabr.

*Apis nigrita*, Fabr. Syst. Ent. (1775) p. 379.

*Xylocopa nigrita*, Fabr. Syst. Piez. (1804) p. 340; Lepel. Hist. Nat. Hym. ii. (1841) p. 179; Smith, Trans. Ent. Soc. 1874, p. 261.

*Xylocopa conjuncta*, Smith, Cat. Hym. Ins. Brit. Mus. ii. (1854) p. 350.

*Xylocopa* (*Koptorthosoma*) *nigrita*, Gribodo, Bull. Soc. Ent. Ital. xxvi. (1894) p. 272.

Five females and one male, Durban (*Distant*); Zomba and Fort Johnston, Nyasaland (*Rendall*).

*Xylocopa modesta*, Smith.

*Xylocopa modesta*, Smith, Cat. Hym. Ins. Brit. Mus. ii. (1854) p. 352 ;  
id. Trans. Ent. Soc. (1874) p. 255.

Two females, six males, Barberton and Fort Johnston,  
Nyasaland (*Rendall*).

*Xylocopa flavorufa*, de Geer.

*Apis flavorufa*, de Geer, Mém. Hist. Ins. vii. (1778) p. 605, pl. xlv.  
fig. 1.

*Xylocopa trepida*, Fabr. Syst. Piez. 1804, p. 340 ; Smith, Trans. Ent.  
Soc. iii. (2) 1856, Proc. p. 130.

*Xylocopa flavorufa*, Lepel. Hist. Nat. Hym. ii. (1841) p. 177 ; Smith,  
Trans. Ent. Soc. (1874) p. 254.

*Xylocopa* (*Koptorthosoma*) *flavorufa*, Gribodo, Bull. Soc. Ent. Ital. xxvi.  
(1894) p. 272.

Seventeen females, Waterberg (*Distant*) ; Durban (*A. Ross*) ;  
Zomba ; Fort Johnston, Nyasaland ; Barberton (*Rendall*) ;  
Albany.

*Xylocopa calens*, Lepel.

*Xylocopa calens*, Lepel. Hist. Nat. Ins. Hym. ii. (1841) p. 196, ♀ ;  
Smith, Trans. Ent. Soc. (1874) p. 261 ; Taschb. Zeits. f. d. ges. Naturw.  
lii. (1879) p. 595.

Three females and ten males, Pretoria (*Distant*) ; Natal  
border (*A. Ross*).

*Xylocopa divisa*, Klug.

*Xylocopa divisa*, Klug, Mag. Ges. naturf. Fr. Berlin, i. (1807) p. 264 ;  
Smith, Trans. Ent. Soc. 1874, p. 259 ; Gribodo, Ann. Mus. Civ. Gen.  
xxi. (1884) p. 281.

Two females and a male, Pretoria, Durban (*Distant* & *Ross*).

## Genus PODALIRIUS, Latr.

*Podalirius acraensis*, Fabr.

*Apis acraensis*, Fabr. Ent. Syst. ii. (1793) p. 329.

*Anthophora acraensis*, Smith, Cat. Hym. Brit. Mus. ii. (1854) p. 343 ;  
Gribodo, Bull. Soc. Ent. Ital. xxv. (1893) p. 283.

Two females, Barberton and Waterberg (*Distant*).

*Podalirius plumipes*, Fabr.

*Apis plumipes*, Fabr. Spec. Ins. i. (1781) p. 480.

*Anthophora atrocincta*, Lepel. Hist. Nat. Hym. ii. (1841) p. 35 ; Dours,  
Mon. icon. Anthoph. (1869) p. 91.

*Anthophora plumipes*, Smith, Cat. Hym. Brit. Mus. ii. (1854) p. 334.

*Podalirius plumipes*, Dalla Torre, Cat. Hym. x. (1893) p. 282.

A single female, Waterberg (*Wildes*).

*Podalirius concinnus*, Klug.

*Megilla concinna* et *crocea*, Klug, Symb. Phys. dec. 5 (1845), Ins. pl. xlix. fig. 11, ♂, and pl. l. fig. 1, ♀ ♂.

*Anthophora concinna*, *crocea* et *vestita*, Cat. Brit. Mus. i. (1854) pp. 329, 330, & 334.

*Anthophora concinna*, Dours, Mon. icon. Anthoph. (1869) p. 180; Radoszk. Hor. Soc. Ent. Ross. xii. (1876) p. 126.

Nine females, two males, Pretoria (*Distant*); Zomba (*Rendall*); Natal border (*A. Ross*).

*Podalirius zonatus*, Linn.

*Apis zonata*, Linn. Syst. Nat. ed. x. (1758) i. p. 576.

*Andrena zonata*, Fabr. Syst. Ent. (1775) p. 377.

*Anthophora zonata*, Latr. Gen. Crust. et Ins. iv. (1809) p. 176; Lepel. Hist. Nat. Hym. ii. (1841) p. 25; Dours, Mon. icon. Anthoph. (1869) p. 57.

Two females and a male, Barberton (*Harrison & Rendall*).

A beautiful variety, the transverse bands of blue scales on the abdomen so broad as to give the entire abdomen a metallic-blue appearance.

*Podalirius fallax*, Smith.

*Anthophora fallax*, Smith, Descr. New Spec. Hym. B. M. (1879) p. 120.

One female and two males, Pretoria (*Distant*); Cape Colony (*Mrs. White*).

*Podalirius rapidus*, Smith.

*Anthophora rapida*, Smith, Descr. New Sp. Hym. B. M. (1879) p. 121.

Three females, four males, Pretoria and Waterval-onder (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

*Podalirius bipartitus*, Smith.

*Anthophora bipartita*, Smith, Cat. Hym. Brit. Mus. ii. (1854) p. 333; Dours, Mon. icon. Anthoph. (1869) p. 81.

One female, one male, Pretoria (*Distant*).

## Genus CROCISA, Jurine.

*Crocisa scutellaris*, Fabr.

*Nomada scutellaris*, Fabr. Spec. Ins. i. (1781) p. 487.

*Melecta scutellaris*, Latr. Hist. Nat. Fourm. (1802) p. 427.

*Crocisa scutellaris*, Jur. Nouv. Méth. class. Hym. (1807) p. 241; Tasch. Hym. Deutsch. (1866) p. 259; Kirby, Ann. & Mag. Nat. Hist. (5) iii. (1884) p. 412; Radoszk. Bull. Soc. Nat. Moscou (1893), p. 169, pl. iv. fig. 9; Friese, Bienen Eur. i. (1895) p. 174.

Six females, eight males, Pretoria, Johannesburg, and



Waterberg (*Distant*); Fort Johnston, Nyasaland (*Rendall*); Grahamstown.

*Crocisa picta*, Smith.

*Crocisa picta*, Smith, Cat. Hym. Ins. B. M. ii. (1854) p. 277.

Two males, Barberton (*Rendall*); Durban, Natal.

This species is barely distinguishable from the Oriental *C. emarginata*, Lepel.

Genus MEGACHILE, Latr.

*Megachile cælocera*, Smith.

*Megachile cælocera*, Smith, Cat. Hym. Ins. B. M. i. (1853) p. 161.

*Chalicodoma cælocera*, Smith, Trans. Ent. Soc. (2) iii. (1856) Proc. p. 129; id. ib. (3) ii. pt. 5 (1865), p. 399, ♂, pl. xxi. fig. 7.

Three females, Johannesburg (*Cregoe*); Barberton (*Rendall*); Durban (*A. Ross*).

*Megachile nasalis*, Smith.

*Megachile nasalis*, Smith, Descr. New Spec. Hym. B. M. (1879) p. 61.

A solitary female from Fort Johnston, Nyasaland (*Rendall*).

*Megachile consanguinea*, Smith.

*Megachile consanguinea*, Smith, Descr. New Spec. Hym. B. M. (1879) p. 63.

Three females, Pretoria and Johannesburg (*Distant*); Barberton (*Rendall*).

*Megachile rufiventris*, Guér.

*Megachile rufiventris*, Guér. Bélâng. Voy. Ind. Orient. (1834) p. 502, pl. iv. fig. 5, ♀; Smith, Cat. Hym. Ins. B. M. i. (1853) p. 178; Sauss. Grandid. Hist. Madagasc. xx. pt. i. (1891) p. 36, ♀ ♂, pls. ii. & iii. figs. 21 a & 21.

*Megachile larvata*, Gerst. Monatsber. Akad. Wiss. Berl. (1857) p. 461, ♂.

Four females, four males, Pretoria (*Distant*); Zomba (*Rendall*); Pemba Island (*Mrs. Burt*).

*Megachile felina*, Gerst.

*Megachile felina*, Gerst. Monatsber. Akad. Wiss. Berl. (1857) p. 461; id. Peters's Reise n. Mossamb., Zool. v. (1862) p. 454, pl. xxix. fig. 9, ♀.

Five females, Waterberg (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

*Megachile cordata*, Smith.

*Megachile cordata*, Smith, Descr. New Spec. Hym. B. M. (1879) p. 62, ♀.

Four females and three males, Pretoria, Lydenburg, and Masil Nek (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

*Megachile maxillosa*, Guér.

*Megachile maxillosa*, Guér. Iconogr. Règn. anim. vii., Ins. (1845) p. 449; Grib. Ann. Mus. Civ. Gen. xxi. (1884) p. 282.

Four females, one male, Pretoria (*Distant*); Durban (*A. Ross*); Fort Johnston, Nyasaland (*Rendall*).

*Megachile apiformis*, Smith.

*Megachile apiformis*, Smith, Cat. Hym. Ins. B. M. i. (1853) p. 162.

A female and male? from Waterval-onder (*Ross*).

I am somewhat doubtful whether I have rightly identified the male; a description of it is subjoined, Smith having only described the female.

♂. Black, finely and closely punctured all over; pubescence yellowish white on the head and abdomen, white on the thorax and legs. Head broader than long; eyes very large, their inner orbits convergent anteriorly; mandibles rather narrow, with the apical tooth long and acute; clypeus truncate anteriorly, vertex broad and somewhat flat, the occiput slightly emarginate. Thorax more or less globose, convex above; the scutellum, postscutellum, and median segment with a rounded curve posteriorly. Wings hyaline; nervures brown; tegulæ black. Legs normal, the anterior tibiæ not dilated; abdomen short and broad, the sides slightly convergent posteriorly, the basal face of the first segment deeply concave, the remaining segments depressed at their bases, the apical segment with numerous teeth along its rounded posterior margin.

Length, ♂, 8.5; exp. 17 millim.

*Megachile tricarinata*, sp. n.

♀. Black, very closely and somewhat coarsely punctured, the punctures running into reticulations on the face in front, on the vertex of the head, and on the scutellum; the sides of the face along the inner orbits of the eyes, the sides of the thorax beneath the wings, a transverse line at the junction of the mesonotum and scutellum, the median segment, and narrow transverse bands, slightly broadened laterally, at the base and apical margin of the first and on the apical margins

of the second to fourth abdominal segments covered with snow-white pubescence; pollen-brush yellowish white; the legs with scattered snow-white hairs, the tarsi with shining ferruginous pubescence. Head from the front nearly circular; eyes large, but not prominent; face flat in front, the inner orbits of the eyes parallel; mandibles grooved and punctured, armed with four teeth; clypeus broad, slightly convex, truncate anteriorly, and with a well-marked medial carina, which is produced upwards nearly to the anterior ocellus; starting one on each side of the anterior ocellus two other vertical carinæ run parallel to the medial one, but terminate at the base of the clypeus. Thorax, the mesonotum gently convex; scutellum semicircular, with a sharp posterior free margin overhanging the postscutellum and median segment, the latter two smooth, shining, and polished, not punctured. Wings hyaline; nervures dark brown; tegulæ black. Legs stout, the apical joint of the tarsi and claws deep yellowish brown. Abdomen rounded and very convex above, the basal face of the first segment concave, smooth, and shining.

Length, ♀, 8; exp. 17 millim.

*Hab.* Pretoria (*Distant*).

Genus ANTHIDIUM, Fabr.

*Anthidium modestum*, sp. n.

♀. Black, the legs dark castaneous brown; an oblique spot on each side of the first, a transverse similar spot on each side but more to the middle on the second, and an oval larger macula on each side of the third, fourth, and fifth abdominal segments yellow, these larger spots not in the same line with the spots on the second segment, but more to the middle of the disk of the segments; pilosity long and abundant, whitish on the face and front, tinged with fulvous on the legs and on the abdominal brush beneath, and rufo-ferruginous on the thorax. Wings fusco-hyaline; a darker streak along the upper half of the radial cell; nervures and tegulæ dark brown; apical joints of the tarsi deep red. Head, thorax, and abdomen minutely but closely punctured, the former two opaque, the latter shining, the tibiae on the outer side more coarsely punctured than the rest of the body.

Length, ♀, 11; exp. 23 millim.

*Hab.* A single specimen recorded from Pretoria (*Zutrzenka*).

This species very closely resembles *A. nigriceps*, Smith, from the Polish Ukraine. It differs, however, in being more stoutly built and in the slightly more close punctuation. The yellow markings on the abdomen are also different.

## Genus SERAPIS, Smith.

*Serapis denticulata*, Smith.

*Serapis denticulatus*, Smith, Cat. Hym. Ins. B. M. ii. (1854) p. 218, ♀ ♂, pl. vii. fig. 2.

Three females, Transvaal, Natal border, and Cape Colony. One bred in the Albany Museum.

## Genus EUSASPIS, Gerst.

*Eusaspis abdominalis*, Fabr.

*Thynnus abdominalis*, Fabr. Ent. Syst. ii. (1793) p. 245.

*Anthophora gastrica*, Illig. Mag. f. Insectk. v. (1806) p. 118.

*Stelis rufiventris*, Lepel. Encycl. Méth., Ins. x. (1825) p. 480.

*Anthidium abdominale et africanum*, Smith, Cat. Hym. Ins. B. M. ii. (1854) p. 209, ♀ ♂, pl. vii. fig. 1.

*Eusaspis abdominalis*, Gerst. Monatsber. Akad. Wiss. Berl. (1857) p. 461; id. Peters's Reise n. Mossamb., Zool. v. (1862) p. 453.

One female, no locality.

*Eusaspis rufiventris*, Gerst.

*Eusaspis rufiventris*, Gerst. Monatsber. Akad. Wiss. Berl. (1857) p. 461, ♀ ♂; id. Peters's Reise n. Mossamb., Zool. v. (1862) p. 453, pl. xxix. figs. 7, ♀, & 8, ♂.

One female, Fort Johnston, Nyasaland (*Rendall*).

## Genus CÆLIOXYS, Latr.

*Cælioxys penetratrix*, Smith.

*Cælioxys penetratrix*, Smith, Descr. New Spec. Hym. B. M. (1879) p. 106, ♀.

One male, Pretoria (*Distant*); one female, Barberton (*Harrison*).

Smith described only the female. The male is similar, black, with the legs red, the scutellar spines or teeth stout, and the abdomen with narrow fasciæ of white pubescence on the apical margins of the segments, but the abdominal segments are strongly constricted at their bases, and the sub-apical and apical segments are armed with spines or teeth, the former with two, one each side on the apical margin laterally, the latter with six, one on each side laterally at base, four at apex, of which the upper ones are broad and dentiform.

Length, ♂, 11.5 millim.



## HETEROGYNA.

## Family Formicidæ.

## Subfamily DORYLINÆ.

## Genus DORYLUS, Fabr.

*Dorylus helvolus*, Linn.

*Vespa helvola*, Linn. Ludov. Ulric. (1764) p. 412.

*Dorylus helvolus*, Fabr. Ent. Syst. ii. (1793) p. 365 ; Lepel. Hist. Nat. Ins. Hym. i. (1836) p. 228 ; Emery, Bull. Soc. Ent. Ital. xix. (1887) p. 350, pl. xi. figs. 1-5.

Six males, Pretoria (*Distant*) ; Zomba, Barberton, Fort Johnston, Nyasaland (*Rendall*).

As is well known, the ♂ of *Dorylus* differs so greatly from the male that for a considerable time it was placed in an entirely different genus—*Typhlopone*, Westw.

*Dorylus juvenculus*, Shuck.

*Dorylus juvenculus*, Shuck. Ann. of Nat. Hist. v. (1840) p. 318 ; Emery, Bull. Soc. Ent. Ital. xix. (1887) p. 350.

*Typhlopone oraniensis*, Lucas, Explor. Sc. Alg., Zool. iii. (1846) p. 302, pl. xvi. fig. 11.

Four males, Pretoria (*Distant*).

*Dorylus attenuatus*, Shuck.

*Dorylus attenuatus*, Shuck. Ann. of Nat. Hist. v. (1840) p. 322.

Two males, Pretoria (*Distant*).

*Dorylus (Rhogmus) fimbriatus*, Shuck.

*Rhogmus fimbriatus*, Shuck. Ann. of Nat. Hist. v. (1840) p. 325 ; Smith, Cat. Hym. B. M. vii. (1859) p. 4, pl. i. fig. 2 ; Gerst. v. d. Decken's Ost-Afr. (1873) p. 347.

Four males, Fort Johnston, Nyasaland (*Rendall*).

## Subfamily MYRMICINÆ.

## Genus CAREBARA, Westw.

*Carebara vidua*, Smith.

*Carebara vidua*, Smith, Cat. Hym. B. M. vi. (1858) p. 179.

*Carebara dua*, Smith, l. c.

*Carebara colossus*, Gerst. Monatsber. Akad. Wiss. Berl. (1858) p. 263.

One male and five females, Pretoria (*Zutrzenka*) ; Barberton (*Rendall*).

## Genus MYRMICARIA, W. Saunders.

*Myrmicaria eumenoides*, Gerst.

*Heptacondylus eumenoides*, Gerst. Monatsber. Akad. Wiss. Berl. (1858) p. 263.

*Physatta natalensis*, Smith, Cat. Hym. B. M. vi. (1858) p. 172.

*Myrmicaria eumenoides*, Mayr, Verh. zool.-bot. Ges. Wien, xvi. (1866) p. 905.

A single worker, Barberton (*Rendall*).

## Subfamily CAMPONOTINÆ.

## Genus ŒCOPHYLLA, Smith.

*Œcophylla smaragdina*, Fabr.

*Formica smaragdina*, Fabr. Syst. Ent. (1775) p. 828.

*Formica macra*, Guér. Voy. Coq., Zool. ii. (1830) p. 202, pl. viii. fig. 1.

*Œcophylla smaragdina*, Smith, Journ. Linn. Soc. iv. (1860) Suppl. p. 102; Emery, Ann. Soc. Ent. Fr. lx. (1891) p. 564.

Four males, Pemba Island (*Burt*).

## Genus FORMICA, Linn.

*Formica rufibarbis*, Fabr.

*Formica rufibarbis*, Fabr. Ent. Syst. ii. (1793) p. 355; E. André, Rev. et Mag. Zool. (3) ii. (1874) p. 185; id. Spec. Hym. Eur. ii. (1882) p. 182, pl. ii. fig. 7; Forel, Bull. Soc. Vaud. sc. nat. (2) xx. (1884) p. 379, pl. xi. figs. 8, 9, & 19.

*Formica cunicularia*, Latr. Ess. Hist. Fourm. Fr. (1798) p. 40; Smith, List Brit. Anim. B. M. pt. 6, Acul. (1851) p. 116.

Three workers and a female, Pretoria (*Distant*).

## Genus CAMPONOTUS, Mayr.

*Camponotus sylvaticus*, Olivier.

*Formica sylvatica*, Oliv. Encycl. Méth., Ins. vi. (1791) p. 491.

*Formica castaneipes*, Leach, Zool. Journ. ii. (1825) p. 290.

*Camponotus sylvaticus*, Roger, Berl. ent. Zeit. vi. (1862) p. 291; Emery, Ann. Mus. Civ. Gen. xxiv. (1887) p. 212.

Several workers, two females, Pretoria (*Distant*); Barberton (*Rendall*).

*Camponotus maculatus*, Fabr.

*Formica maculata*, Fabr. Spec. Ins. i. (1781) p. 491; Smith, Cat. Hym. B. M. vi. (1858) p. 28.

*Formica thoracica*, Fabr. Syst. Piez. (1804) p. 397.

*Camponotus maculatus*, Mayr, Verh. zool.-bot. Ges. Wien, xii. (1862) p. 654; Forel, Grandid. Hist. Madagasc. xx. (1891) p. 29.

*Camponotus sylvaticus* st. *maculatus*, Forel, Bull. Soc. Vaud. sc. nat. (2) xvi. (1879) p. 64.

Several workers, males and females, Pretoria, Johannesburg (*Distant*); Barberton (*Rendall*).

A common and very variable species, found through a great part if not all over Africa.

*Camponotus cosmicus*, Smith.

*Formica cosmica*, Smith, Cat. Hym. B. M. vi. (1858) p. 34.

*Camponotus cosmicus*, Mayr, Verh. zool.-bot. Ges. Wien, xxxvi. (1886) p. 355.

Two workers, Waterval-onder (*Ross*).

*Camponotus natalensis*, Smith.

*Formica natalensis*, Smith, Cat. Hym. B. M. vi. (1858) p. 113.

*Camponotus natalensis*, Roger, Verz. d. Form. (1863) p. 2; Forel, Bull. Soc. Vaud. sc. nat. (2) xvi. (1879) p. 81; Mayr, Verh. zool.-bot. Ges. Wien, xxxvi. (1886) p. 355.

A single worker, Pretoria (*Distant*).

*Camponotus fulvo-pilosus*, de Geer.

*Formica fulvo-pilosa*, de Geer, Mém. Hist. Ins. vii. (1778) p. 613, pl. xlv. figs. 13 & 14.

*Camponotus fulvopilosus*, Mayr, Verh. zool.-bot. Ges. Wien (1862), p. 668; Forel, Bull. Soc. Vaud. sc. nat. xvi. (1879) p. 108; Emery, Bull. Soc. Ent. Ital. xviii. (1886) p. 356.

Eight worker maj., four worker min., Tulbagh, Cape Colony.

A remarkably handsome and conspicuous species.

*Camponotus sericeus*, Fabr.

*Formica sericea*, Fabr. Ent. Syst., Suppl. (1793) p. 279.

*Camponotus sericeus*, Mayr, Verh. zool.-bot. Ges. Wien, xii. (1862) p. 675, pl. xix. fig. 4; Forel, Bull. Soc. Vaud. sc. nat. xvi. (1879) p. 94; André, Spec. Hym. Eur. ii. pt. 13 (1882) p. 149; Forel, Ann. Soc. Ent. Belg. xxx. (1886) p. 192; id. Grandid. Hist. Madagasc. xx. (1891) p. 56.

A single worker, Salisbury, Mashonaland (*Marshall*).

Genus POLYRHACHIS, Smith.

*Polyrhachis schistacea*, Gerstaecker.

*Hoplomyrmus schistaceus*, Gerst. Monatsber. Akad. Wiss. Berl. (1858) p. 262.

*Polyrhachis schistacea*, Gerst. v. d. Decken's Ost-Afrika (1873) p. 342.

Several workers, Pretoria (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

## TUBULIFERA.

## Family Chrysididæ.

## Genus STILBUM, Spinola.

*Stilbum cyanurum*, Forst., var. *splendidum*, Fabr.

*Chrysis splendida*, Fabr. Syst. Ent. (1775) p. 357.

*Chrysis spinolæ*, Montrouzier, Ann. Soc. Linn. Lyon, (2) xi. (1864) p. 249.

*Stilbum variolatum*, Costa, Ann. Mus. Zool. Napoli, ii. (1864) p. 67.

*Stilbum splendidum*, Rits. Tijdschr. v. Ent. xvii. (1874) p. 181; Mocs. Monogr. Chrys. (1889) p. 193.

One male, six females, Pretoria (*Distant*); Transvaal, Natal border (*A. Ross*); Fort Johnston, Nyasaland (*Rendall*).

The male is very dark, almost typical *cyanurum*.

*Chrysis lyncea*, Fabr.

*Chrysis lyncea*, Fabr. Syst. Ent. (1775) p. 357.

*Pyria armata*, Lepel. Encycl. Méth., Ins. x. (1825) p. 495.

*Chrysis lyncea*, Dahlb. Œfvers. Svensk. Vet.-Akad. Förh. vii. (1850) p. 141.

*Chrysis (Hexachrysis) lyncea*, Mocs. Monogr. Chrys. (1889) p. 582.

Nine males and twelve females, Pretoria (*Distant*); Barberton and Fort Johnston, Nyasaland (*Rendall*).

A variable species. Two specimens—one from Barberton and one from Nyasaland—are of a beautiful bright golden-bronze.

*Chrysis modica*, Dahlb.

*Chrysis mediocris*, Dahlb. Despos. Méth., Hym. ii. (1845) p. 14 (nec Dahlb. Hym. Eur. ii. 1854, p. 162).

*Chrysis modica*, Dahlb. Œfvers. Svensk. Vet.-Akad. Förh. vii. (1850) p. 140.

*Chrysis (Hexachrysis) modica*, Mocs. Monogr. Chrys. (1889) p. 556.

One male and one female, Pretoria (*Distant*); Fort Johnston, Nyasaland (*Rendall*).

*Chrysis stilboides*, Spin.

*Chrysis (Pyria) stilboides*, Spin. Ann. Soc. Ent. Fr. vii. (1838) p. 446.

*Stilbum sexdentatum*, Guér. Rev. Zool. (1842) p. 145.

*Chrysis nobilis*, Klug, Symb. Phys. pt. 5 (1845), Ins. pl. xlv. fig. 2; Dahlb. Hym. Eur. ii. (1854) p. 347.

*Pyria stilboides*, Gerst. Pet. Reise n. Mossamb., Zool. v. (1862) p. 519.

*Chrysis (Hexachrysis) stilboides*, Mocs. Monogr. Chrys. (1889) p. 590.

Two females and one male, Pretoria (*Distant*); Transvaal, Natal border (*Ross*).



*Chrysis spina*, Brullé.*Chrysis spina*, Brullé, Hist. Nat. Ins. Hym. iv. (1846) p. 29.*Chrysis abyssinica*, Radoszk. Hor. Soc. Ent. Ross. xii. (1876) p. 148,  
pl. iii. fig. 3.*Chrysis* (*Pentachrysis*) *spina*, Mocs. Monogr. Chrys. (1839) p. 521.A pair, male and female, Pretoria (*Distant*).

## SUPPLEMENTARY LIST.

Since the commencement of this series of papers on the Transvaal Hymenoptera Mr. Distant has received from time to time, and kindly handed over to me for examination, several additional specimens. A list of such as came to hand too late for incorporation in the families and genera as they were worked out is appended below.

## Tribe FOSSORES.

## Family Scoliidæ.

## Genus MYZINE, Latr.

*Myzine capitata*, Smith, Cat. Hym. B. M. iii. (1855) p. 74.Two males, Waterval-onder (*Ross*).*Myzine* sp.A single broken specimen of an entirely black species, possibly new, Waterval-onder (*Ross*).

## Genus SCOLIA, Fabr.

*Scolia* (*Discolia*) *hottentotta*, Sauss. Ann. Soc. Ent. Fr. (3)  
vi. (1858) p. 206.A single female (typical), Johannesburg (*A. Ross*).

## Genus ELIS, Fabr.

*Elis* (*Dielis*) *undulata*, Smith ; *vide* Ann. & Mag. Nat. Hist.  
(7) ix. (1902) p. 348.

A single male from Barberton.

Ann. &amp; Mag. N. Hist. Ser. 7. Vol. xii.

## Family Pompilidæ.

Genus POMPILUS, Fabr. (sens. lat. apud Kohl).

*Pompilus diversus*, Dhlb.; vide Ann. & Mag. Nat. Hist. (7) ix. (1902) p. 348.

A male, Waterval-onder (*A. Ross*).

*Pompilus vindicatus*, Smith; vide Ann. & Mag. Nat. Hist. (7) ix. (1902) p. 349.

A female, Durban (*Ross*).

*Pompilus Distanti*, Bingham; vide Ann. & Mag. Nat. Hist. (7) ix. (1902) p. 349.

A female, Transvaal, Natal border. Not typical: the clypeus and the apical half of the femora, the whole of the tibiæ and tarsi are reddish; absolutely identical, however, in form and sculpture with Saussure's type of *Homonotus cerulans* (nec *Pompilus cerulans*, Lep.).

*Pompilus festivus*?, Klug, Symb. Phys. (1834), Ins. pl. xxxviii. fig. 8.

A single broken specimen of a male from Johannesburg (*Ross*), which, with some doubt, I refer to the above species.

Genus SALIUS, Fabr. (sens. lat. apud Kohl).

*Salius (Hemipepsis) imperialis*, Smith (*Mygnemia*), Cat. Hym. B. M. iii. (1855) p. 188.

Five females, Barberton (*Distant & Rendall*); Waterval-onder and Durban (*Ross*).

*Salius (Hemipepsis) atropos*, Smith; vide Ann. & Mag. Nat. Hist. (7) ix. (1902) p. 353.

A single female without locality.

## Family Sphegidæ.

Genus LIRIS, Fabr.

*Liris diabolica*, Smith; vide Ann. & Mag. Nat. Hist. (7) x. (1902) p. 209.

A single female, Barberton (*Rendall*).

## Genus STIZUS, Latr.

*Stizus tenuicornis*, Smith; *vide* Ann. & Mag. Nat. Hist. (7) x. (1902) p. 210.

A single female, Figtree Creek, Barberton (*Rendall*).

*Stizus argentifrons*, Smith; *vide* Ann. & Mag. Nat. Hist. (7) x. (1902) p. 210.

A fine female, in good condition, identical with the type, Johannesburg (*Fry*).

## Genus CERCERIS, Latr.

*Cerceris albifrons*, Smith, Cat. Hym. B. M. iv. (1856) p. 449.

A single female, Johannesburg (*Fry*). Identical with the type in the British Museum.

## Genus AMPULEX, Jurine.

*Ampulex compressa*, Fabr.; *vide* Ann. & Mag. Nat. Hist. (7) x. (1902) p. 217.

A single female, Pemba Island (*Burt*).

## Genus AMMOPHILA, Kirby.

*Ammophila hirsuta*?, Scop. Ent. Carn. (1763) p. 292, pl. xlii. fig. 772.

A single female, Johannesburg (*Ross*), which seems identical with European examples, except that the colours are brighter. Possibly a new species.

## Tribe DIPLOPTERA.

## Family Eumenidæ.

## Genus EUMENES.

*Eumenes Lepeletieri*, Sauss.; *vide* Ann. & Mag. Nat. Hist. (7) x. (1902) p. 219.

A single male, Johannesburg (*Ross*).

## Genus RHYNCHIUM, Spin.

*Rhynchium cyanopterum*, Sauss.; *vide* Ann. & Mag. Nat. Hist. (7) x. (1902) p. 221.

*Rhynchium laterale*, Fabr. (*Vespa*) Spec. Ins. i. (1781) p. 466.

A single male, Pretoria (*Donovan*). A small variety, with the lateral yellow stripe along the abdomen reduced to separate spots on each segment.

#### Genus ODYNERUS, Latr.

*Odynerus hottentottus*, Sauss. Étud. Vesp. iii. (1856) p. 244.

A single female, Johannesburg (*Fry*).

*Odynerus eumenoides*, Smith, Cat. Hym. B. M. v. (1857) p. 71.

A single male, Johannesburg (*Fry*).

#### Genus SYNAGRIS, Latr.

*Synagris mirabilis*, Guér. ; *vide supra*, p. 47.

Two females, Pretoria (*Donovan*) ; Pemba Island (*Burt*).

*Synagris analis*, Sauss. ; *vide supra*, p. 47.

Two females, Figtree Creek, Barberton (*Rendall*).

*Synagris emarginata*, Sauss. ; *vide supra*, p. 47.

One female, Figtree Creek, Barberton (*Rendall*).

*Synagris dentata*, Sauss. Étud. Vesp. i. (1852) p. 80, pl. xiii. fig. 3.

A single female without locality.

#### Family Vespidae.

##### Genus BELONOGASTER.

*Belonogaster fliventris*, Sauss. ; *vide supra*, p. 47.

##### Genus POLISTES, Latr.

*Polistes fastidiosus*, Sauss. ; *vide supra*, p. 48.

A single worker, Figtree Creek, Barberton (*Rendall*).

##### Genus ICARIA, Sauss.

*Icaria clavata*, Sauss. ; *vide supra*, p. 48.

A single worker, Figtree Creek, Barberton (*Rendall*).



## Tribe ANTHOPHILA.

## Family Apidæ.

## Genus XYLOCOPA.

*Xylocopa olivacea*, Spin. ; *vide supra*, p. 54.

A single female, Uganda (*Crabtree*).

## Genus PODALIRIUS, Latr.

*Podalirius rapidus*, Smith ; *vide supra*, p. 56.

A single female, Johannesburg (*Ross*).

## Genus CROCISA, Jurine.

*Crocisa scutellaris*, Fabr. ; *vide supra*, p. 56.

A single male, Figtree Creek, Barberton (*Rendall*).

## Genus MEGACHILE, Latr.

*Megachile consanguinea*, Smith ; *vide supra*, p. 57.

A single male, Johannesburg (*Ross*).

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IV.—*Descriptions of new Genera and Species of New Zealand Coleoptera.* By Capt. T. BROWN, F.E.S.

[Concluded from vol. xi. p. 618.]

## Group Opatridæ.

*Syrphetodes simplex*, sp. n.

*Opaque*, fuscous ; sides of thorax and elytra, the legs, and antennæ rufescent ; densely clothed with variegate fuscous and ochraceous setæ.

*Antennæ* rather elongate and slender, club densely pubescent. *Thorax* nearly as long as broad, the anterior angles project as far as the front of the eyes, but are not widely distant from them ; the broadest part is behind the middle ; the sides in front are nearly straight, but they are a little sinuously narrowed towards the rectangular hind angles ; there is a slight median impression in front, and the disk behind the middle is obtusely elevated. *Elytra* oblong,

shoulders and apices rounded, nearly twice the width of the thorax; there are two elongate elevations on each near the base and one on top of the posterior declivity, besides some smaller ones; the punctuation is coarse and irregular, but the foveiform cavities along the explanate sides are serial. *Legs* maculate.

This does not closely resemble any other species. Its chief characteristics are the rather slender antennæ and comparatively inconspicuous nodiform elevations.

Length  $4\frac{1}{4}$ , breadth  $2\frac{1}{8}$  lines.

Picton.

Mr. J. J. Walker, during a recent collecting expedition, secured three or four specimens, one of which he placed at my disposal.

#### Group *Ædemeridæ*.

##### *Thelyphassa fuscata*, sp. n.

*Elongate*, depressed, infusate.

*Head* finely punctured. *Thorax* longer than broad, widest near the front, gradually narrowed behind, but with the basal margin somewhat thickened and prominent; its punctuation is similar to that of the head; near the sides there is some fine inconspicuous pubescence. *Scutellum* rather large. *Elytra* dull, elongate, with rounded apices; they are lightly but closely punctured and have two indistinct dorsal lines on each; they are covered with fine greyish hairs.

When compared with *T. diaphana* the opaque pale fuscous surface first strikes the eye. The thorax lacks the impressions and raised central space. The semicircular notch of the terminal joints of the male palpi is rather smaller, but deeper, and the inner margins are more swollen or angulate beyond the middle.

The apical ventral segment is quite uncovered in both sexes.

Length  $5\frac{1}{2}$ –6, breadth  $1\frac{1}{4}$ – $1\frac{1}{2}$  lines.

Westport.

One pair presented to me by Mr. J. J. Walker.

##### *Techmessa longicollis*, sp. n.

*Elongate*, moderately nitid; head and thorax black; elytra bluish black and with decumbent greyish-yellow pubescence; antennæ fuscous, but with the basal portion of each joint rufescent; legs and palpi yellow, tarsi infusate.

*Head* rather broader than the thorax, coarsely punctate,

the punctures much closer behind. *Epistome* pallid. *Thorax* a little longer than broad, rather wider just before the middle than it is elsewhere, suboviform; without depressions, its punctuation moderately coarse, quite dense near the sides; on the disk there are slight irregular smooth spaces. *Scutellum* closely but finely sculptured. *Elytra* elongate, parallel-sided, coarsely, moderately closely, and somewhat rugosely punctured. *Underside* nigrescent.

*T. telephoroides* has the thorax "distinctly wider than long"; in this species the reverse obtains. There are differences in coloration, and the eyes are rather larger and more prominent. The second joint of the antennæ is barely more than half the length of the third; this latter is only about one third shorter than the fourth.

Length  $2\frac{3}{4}$ , breadth  $\frac{3}{4}$  line.

Tarukenga, near Rotorua.

One example in my own collection, found about eight years ago.

*Exocalopus antennalis*, sp. n.

*Elongate*, subdepressed; head and thorax glossy black; elytra dark violaceous, sparingly clothed with fine, erect, infusate hairs; legs and antennæ fuscous.

*Head*, including the prominent eyes, broader than the thorax, obliquely narrowed behind; there is an almost diamond-shaped depression on the vertex, with slightly raised smooth borders extending towards the antennæ; the rest of its surface is distinctly and rather closely punctured. *Thorax* transverse, strongly rounded laterally; its whole surface is distinctly but not closely punctate and there is an irregularly formed fovea-like impression at each side. *Scutellum* punctate. *Elytra* elongate-oblong, parallel-sided, moderately coarsely, closely, and almost rugosely punctured.

*Antennæ* almost as long as the body, with very short pubescence; basal joint pyriform, second and third castaneous, transverse, and, conjointly, shorter than first; joints 4-10 slender and equally elongate, each of these has a filiform appendage quite twice the length of the joint itself; the eleventh is about double the length of the preceding one.

*Female*.—The antennæ attain the middle femora or just beyond them, their second joint is bead-like; the third, though distinctly longer than the preceding, is obviously shorter than the following one; joints 4-10 are elongate and moderately serrate, the eleventh elongate-oval. This sex is rather larger than the male; the thorax and head are more coarsely punctured and the legs are paler.

This species is shorter than *E. pectinatus*, the head and thorax are differently sculptured and have more limited smooth areas. The antennal appendages, instead of springing from the middle of the joints, as they do in the typical form, proceed from near the base and are twice as long; the antennæ of the male therefore are even more elegant.

♂. Length  $2\frac{1}{8}$ , breadth nearly  $\frac{3}{4}$  line.

Tarukenga, near Rotorua.

I found one male and two females about eight years ago.

#### Group Otiorhynchidæ.

##### *Cecyropa lineifera*, sp. n.

*Robust*, convex, opaque; densely covered with minute, circular, depressed, grey and fuscous scales; those of the latter colour occupy most of the dorsum; there are also numerous short erect setæ there; legs and antennæ dark ferruginous.

*Rostrum* less than half a line long, its apical portion rufopiceous, punctate, and nearly nude; along the middle a fine groove extends as far as the back part of the eyes. *Scape* slightly and very gradually incrassate; it bears grey squamæ and outstanding setæ. *Funiculus* sparsely setose, second joint slightly shorter and obviously more slender than the first, seventh larger than the intermediate ones; club quadri-articulate, short-oval, finely pubescent. *Eyes* transversely oval, the space between each and the thorax equal to its own width. *Thorax* one third broader than long, its sides strongly curved, the base evidently wider than the apex; it has an ill-defined dorsal groove; all other sculpture is concealed by the squamosity; along each side there are many elongate grey setæ. *Elytra* broader than thorax, widest, and almost prominent, a short distance behind the obliquely rounded shoulders, much narrowed posteriorly; three or four striæ are visible on each near the suture and four or five near the apex, these have rather narrow and moderately distant punctures; towards the sides the punctures are serial, but nowhere coarse. *Legs* stout, clothed with grey scales and setæ; anterior tibiæ flexuous, their frontal or outer dilatation overlaps the basal tarsal joint; third tarsal joint expanded to more than twice the width of the second; claws small. *Metasternum* and basal abdominal segment broadly impressed along the middle.

Of about the same size as *C. maritima*, but with a longer rostrum, more convex eyes, and quite dissimilar sculpture.

Length (rostr. incl.)  $3\frac{1}{2}$ , breadth  $1\frac{1}{2}$  lines.

Westport.

One example from Mr. J. J. Walker.



*Cecyropa striata*, sp. n.

*Convex*, opaque, covered with minute, dull, dark grey or almost infuscate squamosity, the sides of thorax and hind body with rather short erect setæ; the elytral interstices bear short, almost brassy setæ; legs and antennæ rufescent.

*Rostrum* sparsely squamose, nearly bare in front, with a well-marked linear impression nearly reaching the back part of the head. *Eyes* obliquely oval. *Scape* but little thickened apically, with a few grey squamæ and slender setæ. *Funiculus* finely setose, second joint about as long as the first, but only about half as thick, seventh broader than the preceding one; club short, oval, finely pubescent. *Thorax* one fourth shorter than broad, its sides strongly rounded, the apex rather narrower than the base, without evident sculpture, but probably with punctures underneath the scales. *Elytra* broader than thorax at the base, shoulders oblique; the three punctated striæ near the suture on each are fairly well marked throughout; the external ones almost assume the form of rather narrow serial punctures.

This can be best compared with the eastern *C. setigera* (no. 1617); in that species, however, joints 3-7 of the funiculus are more transverse and moniliform, the thorax is more gradually narrowed anteriorly and continues broad to within a short distance of the base, the elytral striæ are less distinct and their punctures are still finer, the groove on the rostrum is quite abbreviate, and the eyes are less convex. In *C. striata*, moreover, the ocular lobes, though rather feeble, are certainly more apparent than they are in *C. setigera*.

Length (rostr. incl.)  $2\frac{1}{8}$ , breadth  $\frac{7}{8}$  line.

Westport.

This is another of Mr. J. J. Walker's captures during a short stay in that neighbourhood. I have seen one individual only.

*Brachyolus albescens*, sp. n.

*Convex*, subovate, completely covered with white and brassy squamæ; these occupy irregular, somewhat transverse areas, but do not form spots; antennæ and tarsi ferruginous.

*Rostrum* shorter than thorax, dark red and pilose in front, squamose behind. *Scrobes* open above, curvate at the sides, with a distinct squamose space between them and the eyes. *Scape* very gradually thickened, clothed with scales and short curled setæ. *Funiculus* evidently longer than scape, red, with fine grey setæ; basal two joints about equal in length, 3-7 almost moniliform. *Club* oval, infusate.



*Eyes* oblique, not prominent, just free. *Thorax* with well-developed ocular lobes, one fifth broader than long, widest before the middle, rounded there, slightly narrowed but straight behind; there is an ill-defined dorsal groove, an oblique impression near each side in front, and one on each side below; the lateral margins near the base are somewhat plicate, but the punctuation is invisible from above. *Elytra* broadly oval, shoulders so rounded that they scarcely exceed the thorax in width; the series of punctures are coarser towards the sides than those nearest the suture; the third interstices are obtusely elevated near the base, nearly plane on the disk, and end in nodosities on top of the declivity; there is a swelling of each side outside these, but no nodosity. There are a few grey setæ on the thorax and on the sides of the elytra, but no regular series.

*Var.*— $2\frac{1}{4} \times 1$  line; this bears three fuscous spots on the base of the thorax.

In *B. elegans* (no. 2115) the third interstices are raised throughout, the nodosities are relatively larger and situated higher up, and the suture is nodiform near the apex. The scrobes are shorter. No. 2386 (*B. viridescens*) has stouter legs, broader tarsi, and a longer club. The five species described by Dr. Sharp all differ from this.

Length (rostr. incl.) 2, breadth  $\frac{3}{4}$  line.

Karori and Wadestown (Mr. G. V. Hudson).

*Brachyolus cervicalis*, sp. n.

*Opaque*, densely covered with fawn-coloured scales above, the posterior declivity with grey; there are series of decumbent setæ on the elytral interstices and others on the front of the thorax, some of these are greyish; antennæ and legs ferruginous.

*Rostrum* shorter than the thorax, with a central carina, along each side of the latter there is a broad shallow groove, but the rostrum is not distinctly tricarinate. *Scrobes* short, almost foveiform. *Funiculus* with fine grey setæ, basal two joints equal, the second but little more slender than the first, third also elongate yet shorter than the preceding one, fourth longer than broad. *Eyes* not contiguous with thorax, oblique, broadly oval. *Thorax* subquadrate, slightly broader than it is long, widest before the middle, its sides rounded there but nearly straight behind, the surface uneven but without well-marked sculpture. *Elytra*, at the middle, nearly twice the width of the thorax, almost parallel-sided there; shoulders so narrowed as not perceptibly to exceed the breadth of the

thorax at the base, the posterior declivity much narrowed; apices slightly divergent; dorsum rather flat, with serial punctures, the two sutural rows on each elytron are very small; the third and fifth interstices are very indistinctly elevated but terminate behind in horizontal projections, those on the third much larger than the others, the suture is a little raised at the summit of the hind declivity, and halfway down there is a crest. Legs and tarsi stout.

*B. posticalis* is a smaller and more brightly coloured insect with scattered, but conspicuous, white setæ; joints 3-7 of the funiculus are bead-like, and the whole sculpture is different. Sharp's *B. punctipennis* has the elytra wider than the thorax at the base, and his *B. longicollis* (No. 2120) is without nodosities.

Length (rostr. incl.)  $2\frac{3}{4}$ , breadth  $1\frac{1}{4}$  lines.

Karori and Pakuratahi.

One example from Mr. G. V. Hudson.

*Aphela pictipes*, sp. n.

*Subovate*, convex, slightly nitid, sparsely setose; pale testaceous, the tip of the rostrum, tarsi, and extremity of the tibiæ dark fuscous.

*Rostrum* a little contracted towards the antennal insertion, longitudinally rugose, with irregular smooth spaces. *Antennæ* sparingly setose; first joint of funiculus thick, second rather longer but more slender at base, joints 3 to 6 very short, seventh broadest; club compact, finely pubescent. *Thorax* broader than it is long, apex truncate, base moderately rounded so as to be closely adapted to the elytra, it is widest before the middle, the sides, nevertheless, are but little curved; its surface coarsely and rugosely punctured. *Elytra* slightly wider than thorax at the base, shoulders somewhat narrowed; their grooves crenate rather than coarsely punctate; interstices with short, erect, pallid setæ, sometimes appearing as if crossed with linear impressions.

*Legs* stout; anterior tibiæ expanded at the extremity. Tarsi broad, basal two joints very short and widely emarginate so as to be almost lunate, third deeply bilobed, fourth as long as the preceding two conjointly, stout; claws short and stout.

Length (rostr. incl.)  $1\frac{1}{2}$ , breadth  $\frac{3}{4}$  line.

Sumner.

Three examples from Mr. J. J. Walker.

The discovery of this species would seem to invalidate my genus *Stygeopetes*. The eyes are rather less convex than

these organs in *Stygeopetes littoralis*, so that the head seems less abruptly broader than the rostrum; the thorax is obviously more transverse and its punctuation is not quite so deep and less disposed in series. The front tibiæ at the lower or inner extremity terminate in a short calcar. The coloration is uniformly paler and never rufescent as is sometimes the case in *S. littoralis*. The dark tarsi are distinctive.

### Group *Cylindrorhinidæ*.

#### *Anagotus pallescens*, sp. n.

*Opaque*, black, densely covered with minute, depressed, rounded, greyish squamæ, and a few coarse setæ of an ochraceous hue.

*Rostrum* dilated in front, of the same length as the thorax, with an elevation at each side over the point of the antennal insertion, the intervening space apparently concave, and with a fine central carina extending as far as the eyes. *Head* narrowed anteriorly. *Eyes* slightly convex, transverse, as far apart above as they are distant from the thorax. *Thorax* just as long as broad, widest near the front, narrowed, yet nearly straight-sided behind; there are two prominent elongate tubercles on the middle of the front, two more rounded ones close behind these, one on each side at the broadest part, and a pair of smaller ones near the base. *Scutellum* subtriangular. *Elytra* slightly wider than thorax at the base, shoulders narrow, much narrowed posteriorly, sides almost vertical but sloping inwards; each elytron with three large tubercles near the suture, a rather smaller lateral one in line with the third, which is situated at the summit of the posterior declivity, a small one near the apex, two series near the side, and two series of still smaller ones between these last and the suture.

*Scape* gradually incrassate, touching the centre of the eye, and bearing depressed elongate ochraceous scales. *Funiculus* piceous, hispid, second joint distinctly longer than first, the seventh longer and broader than the intermediate joints; club elongate-oval, densely and finely pubescent. *Legs* elongate, simple; the femora with an indistinct pale band, on each, beyond the middle. *Tarsi* slender, setose; their third joint broadly excavate above, but without obvious lobes.

*Prosternum* deeply emarginate. *Ocular* lobes moderately developed. *Abdomen* elongate, second segment hardly as long as the third and fourth conjointly. Near the tip of the rostrum there are some outstanding yellow setæ.

The smaller bulk, different squamosity, &c. distinguish this from the typical species, No. 2144.

Length (rostr. incl.) 8, breadth  $2\frac{3}{4}$  lines.

Te Oneroa.

I am indebted to Mr. Percy Seymour for the only specimen I have seen.

SARGON, gen. nov.

*Rostrum* moderately elongate, subparallel, only slightly dilated in front. *Scrobes* deep in front and visible from above, they extend to the front of the eyes. *Scape* gradually thickened, reaching just beyond back of eye. *Funiculus* 7-articulate, basal two joints about equally elongate. *Club* elongate-oval. *Eyes* quite lateral, rotundate, moderately convex, not angulate below. *Thorax* truncate at base and apex, without distinct ocular lobes. *Elytra* moderately long, rather broader than thorax. *Femora* medially incrassate. *Tibiae* flexuous; anterior inwardly produced, with a short calcar; the posterior dilated at extremity, with a narrow groove between the double series of external cilia. *Tarsi* normal.

*Prosternum* only slightly emarginate at apex; coxæ contiguous. Intermediate coxæ slightly separated. Basal ventral segment longer than second; third and fourth equal, each more than half the length of second.

Resembles *Inophlæus inuus*, but the scrobes, eyes, rostrum, and abdomen differ, and as the type of *Sargon* is almost destitute of ocular lobes it cannot be associated with *Inophlæus*.

*Sargon carinatus*, sp. n.

*Opaque*, piceous, densely covered with small depressed greyish scales.

*Head* and rostrum as long as the thorax; rostrum with an abbreviated central carina. *Eyes* moderately convex, distinctly faceted, distant from thorax. *Antennæ* nigrescent, club densely and finely pubescent. *Thorax* subquadrate, slightly wider before the middle than it is elsewhere, with a well-marked dorsal furrow; the squamæ are nearly round, and many exhibit a pinkish hue. *Elytra* a little rounded towards the base, which, however, is slightly wider than that of the thorax; disk nearly plane, posterior slope moderately abrupt, sides nearly vertical but inclined inwards, apices acutely rounded and divergent but not prolonged; they are striate, the third and fifth interstices are gradually raised backwards and end suddenly on the summit of the declivity



without forming nodiform elevations; the scales are more elongate than those of the thorax. *Legs* stout, with elongate squamæ and setæ.

*Underside* clothed like the upper surface but more rufescent, the abdomen, however, bears hair-like squamosity.

Length (rostr. incl.) 7, breadth  $2\frac{1}{2}$  lines.

Wanganui.

Two examples were given to me several years ago by Mr. Marshall of the Collegiate School.

### Group Rhyparosomidæ.

#### MEMES, gen. nov.

*Body* convex, subovate. *Rostrum* longer than thorax, slightly arched, parallel, very slightly expanded just before the middle. *Scrobes* straight, almost attaining the front of the eyes, they begin near the apex (about one third of the length of the rostrum) and at that part are open and visible from above. *Eyes* depressed, their greatest bulk is from above downwards; they are widely separated, and not quite free from the thorax. *Scape* moderately incrassate at the extremity, it almost touches the eye. *Funiculus* rather longer than the scape, basal articulation rather larger than the second, both longer than broad; joints 3-7 transverse. *Club* compact, oval, indistinctly articulated. *Thorax* about as long as it is broad, with ocular lobes. *Elytra* apparently connate, humeral angles obtusely prominent, scutellar region depressed. *Legs* long and stout. *Femora* slender near the base, much dilated medially, arched above, with a strong dentiform projection underneath. *Tibiæ* flexuous; the anterior deeply incurved, inwardly, near the base, broadly expanded below, and terminating in a stout curvate frontal spur. *Tarsi* slender, their third joint deeply excavate above, with short lobes; claws small and slender.

*Prosternum* deeply emarginate. Front *coxæ* contiguous, middle pair moderately, the posterior widely separated. *Sternum* longitudinally impressed. *Abdomen* with short intermediate segments.

This genus should be located near *Bantiades*. Although the legs are similar in both genera, yet there are other material differences. *Bantiades* has a shorter and thicker rostrum with deep polished scrobes, the antennal insertion is subapical, the body is broader and more densely and coarsely clothed, and the shoulders are not free.



*Memes rufirostris*, sp. n.

*Fuscous*, slightly shining, sparsely setose; the rostrum, antennæ, legs, and an ill-defined fascia in line with the posterior femora more or less ferruginous.

*Rostrum* almost nude, punctate behind, its frontal sculpture linear. *Scape* glabrous; funiculus with some slender grey setæ, club finely pubescent. *Thorax* truncate and somewhat rufescent in front, this portion constricted, sides moderately rounded; there is an obscure, central, smooth space which can scarcely be termed a carina, and a few inconspicuous tubercular elevations, the rest of its surface has shallow punctures and the middle of the base is depressed. *Elytra* wider than the thorax at the base, which is incurved, their sides nearly straight, slightly wider near the hind thighs, narrowed behind, shoulders reddish; each elytron has five or six series of coarse discoidal punctures, but the posterior sculpture assumes the form of striæ; the clothing consists principally of decumbent, slender, greyish or yellowish, setæ, which are somewhat concentrated near the top of the hind declivity, whilst the basal half appears as bare as the thorax. The *legs* bear short erect setæ.

Length (rostr. incl.)  $2\frac{1}{8}$ , breadth  $\frac{7}{8}$  line.

Westport.

Found by Mr. J. J. Walker; one example only.

Group *Eirirhinidæ*.*XEROSTYGNUS*, gen. nov.

*Body* moderately elongate, slightly convex, densely squamose. *Rostrum* nearly as long as the thorax, a little arched, subparallel, slightly wider in front than behind. Scrobes extend from near the apex to the eyes, well marked throughout, and at the antennal insertion are open and discernible above. *Eyes* transverse, distinctly faceted, fringed with setæ behind, not prominent, just free from the thorax, widely separated above. *Scape* slender, thickened at extremity, almost touching the eye. *Funiculus* 7-articulate, first joint rather larger than the second, seventh a little larger than the preceding one. *Club* oval, three-jointed. *Thorax* subquadrate, gently narrowed anteriorly, base feebly bisinuate, apex truncate, with ocular lobes. *Scutellum* oviform. *Elytra* oblong, gradually attenuate posteriorly, shoulders oblique, rather wider than the thorax at the base. *Legs* elongate. *Femora* medially clavate, notched and grooved below near the extremity. *Tibiæ* somewhat flexuous, with a minute

calcar at the outer angle. *Tarsi* pilose underneath, basal two joints cordiform, third bilobed; claws simple.

*Prosternum* deeply emarginate. Front *coxae* prominent and contiguous, the intermediate slightly separated, the posterior widely. *Metasternum* scarcely longer than the basal segment of the abdomen, second segment as long as the following two taken together, the apical subconical.

*Xerostygnus binodulus*, sp. n.

*Elongate-ovate*, opaque, fuscous; uniformly and closely covered with small, round, depressed scales of a tawny or yellowish-grey colour, and with some fine setæ; legs and antennæ rufescent, the tarsi sometimes piceous.

*Rostrum* stout, with a feeble central carina, its apical portion nude, pitchy, and punctate. *Thorax* slightly narrowed towards the front; there is a smooth linear space on the middle, but the punctuation is quite concealed by the squamosity. *Scutellum* elongate, oval, squamose. *Elytra* broader than the thorax at the base, a little emarginate there; they are punctate-striate, the punctures, however, are not easily seen, there is a series of short greyish setæ on each of the interstices, and the fifth interstices terminate below the summit of the hind slope in small nodosities, one on each.

*Underside* clothed with squamæ and decumbent setæ, the latter are almost confined to the abdomen and middle part of the metasternum. The basal two segments are broadly impressed, and the terminal has a median depression at its apex.

Length (rostr. incl.)  $3\frac{1}{4}$ , breadth 1 line.

Auckland.

My first specimen, much mutilated, was received from Dr. Harold Swale, and two others were afterwards given to me by Mr. J. J. Walker. All were found frequenting rushes at the margins of Lake St. John.

*Stephanorhynchus pygmaeus*, sp. n.

*Opaque*, nigrescent, the elytra and front of thorax reddish, scutellum grey; sparingly clothed with depressed grey setæ.

*Rostrum* parallel-sided, rather shorter than the head. *Funiculus* somewhat shorter than the scape, second joint about half the bulk of the first, 3-7 transverse. *Head* elongate, much contracted behind, rather coarsely and closely punctured. *Eyes* large, widely separated above, placed in front of the broad anterior part of the head. *Thorax* of nearly the same length and breadth, much narrowed

anteriorly, constricted there, its punctuation transverse and rugose. *Elytra* oblong, nearly double the width of thorax at the base, gradually narrowed backwards; they are striate-punctate, each bears a small elevation in line with the hind thighs, and another, nearer the side, near the top of the hind slope. *Femora* clavate, the posterior with a large angulation or tooth underneath. *Tibiæ* flexuous. *Tarsi* slender, the anterior with very narrow basal articulations, third joint expanded, with elongate lobes.

This is a minute member of the *S. Lawsoni* series. It may be at once distinguished from *S. nigrosparsa* by its small size, the slender second joint of the tarsi, and by the entire absence of the broad groove along the middle of the head.

Length (rostr. excl.)  $1\frac{1}{4}$ , breadth  $\frac{3}{8}$  line.

Mount Arthur.

One example from the collection made by Messrs. Cheeseman and Adams.

### Group Cerambycidae.

#### DROTOTELUS, gen. nov.

*Head* broad, nearly vertical, and prolonged anteriorly, contracted behind so as to form a short neck. *Eyes* distinctly faceted, large, sublunate, deeply emarginate in front, their greatest bulk in front. *Antennæ* inserted in projections close to the ocular emarginations, as long as the body; basal joint stout, curvate, its length twice the breadth, second very short, joints 3–11 filiform, third longer than first but shorter than fourth, fifth to seventh each longer than fourth. *Thorax* elongate, deeply constricted before and behind the obtusely dilated postmedian part of its sides. *Scutellum* triangular. *Elytra* with obtusely prominent shoulders, they taper gradually backwards, apices nearly truncate. *Legs* slender, pilose. *Tarsi* setose above, anterior densely clothed underneath with squamiform setæ, and fringed laterally, basal joint rather larger than second, the third cleft to the base, with long slender lobes.

Front *coxæ* prominent, situated at the base of the prosternum, almost contiguous, being separated by the thin margins of the cavities only. *Metasternum* convex, medially canaliculate. *Abdomen* elongate and narrow, basal segment hardly twice the length of the second, third and fourth decrease, fifth about as long as the preceding one, rounded and ciliated at the extremity.

This seems to be a quite isolated form. It may be described. *Ann. & Mag. N. Hist. Ser. 7. Vol. xii.*

tinguished from *Calliprason* and its allies by its broad perpendicular face, antennal prominences, attenuate elytra, &c. *Drotus* has a similarly formed thorax, but, otherwise, is essentially different. The nearest Australian genus is, perhaps, *Stenoderus*, but here again the disparities are important.

*Drototelus politus*, sp. n.

*Elongate*, almost wholly nude, smooth and shining; head and thorax castaneo-rufous; the dilated sides of the latter, the forehead, base of femora, and hind tarsi pale yellow; antennæ infusate; legs reddish, the two front pairs of tarsi fusco-castaneous; elytra testaceous, irregularly stained with reddish.

*Head* with a deep inter-antennal channel, the parallel-sided neck finely punctate. *Thorax* as broad as it is long, strongly, yet obtusely, dilated at the sides just behind the middle, deeply constricted near the base and in front of the lateral prominences, apex truncate, base somewhat bisinuate; at its widest part, on the dorsum, there is a pair of moderate obtuse elevations, the broad depression in front of these does not extend backwards. *Elytra* nearly truncate and twice the width of the thorax at the base, humeral angles slightly raised and obtusely prominent, the sutural margins almost cariniform, lateral margins sharply defined, most distinct behind the posterior femora, apical region slightly swollen. *Antennæ* dull, with very short pubescence, but the basal joints are nearly glabrous, finely punctate and shining.

Length  $4\frac{1}{4}$ , breadth  $1\frac{1}{8}$  line.

Karori, Wellington.

I am indebted to Mr. G. V. Hudson for my specimen.

Group *Lamiidæ*.

*Hybolasius cognatus*, sp. n.

*Variagate*, rufo-piceous, with yellowish-grey pubescence; the crests, and some patches on the hind slope, of the elytra somewhat rufescent; antennæ rufo-castaneous, with infusate hairs; legs pitchy red, with grey villosity.

*Head* densely sculptured, with an inter-antennal depression and smooth frontal line. *Thorax* almost as long as it is broad, lateral tubercles distinct but rather small, behind these it is constricted, the disk is a little uneven, depressed before and behind, with its surface closely rugose. *Scutellum* large, fringed with yellowish hairs. *Elytra* convex, slightly attenuate posteriorly, with obtuse but prominent shoulders;



near the base and suture there is a pair of strongly elevated crests, and nearly in line with these, in front of the apical slope, there is a pair of elongated swellings, between which the suture appears a little thickened and carinate; their punctuation is irregular, coarse on some parts and finer on others, but it does not extend beyond the posterior inequalities, the apices are reddish and strongly rounded. *Femora* strongly dilated; the *tibiæ*, more particularly the intermediate, bear short black hairs near the extremity; the tarsi are darker than the legs. *Antennæ* rather longer than the body, basal joint strongly clavate and dark red, third rather longer than fourth, the latter somewhat curvate, the following joints differ but little.

This might be looked upon as a diminutive form of *H. cristus*, the thorax, however, is relatively longer and narrower, the punctures on the hind body are comparatively coarser, and there are some other minor differences.

Length  $2\frac{1}{2}$ , breadth  $\frac{7}{8}$  line.

Wadestown, near Wellington.

One example from Mr. G. V. Hudson.

*Hybolasius laticollis*, sp. n.

*Subdepressed*, oblong; thorax and basal three joints of antennæ pale chestnut-red, the legs of a similar hue, but the *tibiæ*, like the remaining joints of the antennæ, are infuscate towards the extremity; elytra variegated with pale fuscous and light green, the latter colour conspicuous at the sides and base; the pubescence is rather scanty, decumbent, and greyish, but the legs and first four joints of the antennæ bear outstanding, elongate, grey hairs.

*Head* finely sculptured, with a central linear impression extending from the thorax to the muzzle, the antennal tubercles are flattened so that the vertex seems plane. The ninth joint of the *antennæ* attains the apex of the elytron, their basal joint is rather long and more oviform than clavate, the third slightly exceeds the fourth in length. *Thorax* strongly transverse, the width being double the length, lateral tubercles small and inconspicuous; its surface is slightly uneven, with rather fine rugæ, and has a minute polished nodule just behind the middle. *Scutellum* medially concave. *Elytra* but little broader than the thorax, moderately coarsely punctured, the punctures are closer before the middle than elsewhere, and become quite distant and scattered behind; near the base there is an obtuse rounded swelling, on each, and an elongate one halfway between



the middle and apex. *Femora* moderately inflated, *tibiæ* rather slender.

The remarkably broad and short thorax, peculiar coloration, and inconspicuous antennal tubercles will enable this species to be identified. We have no similar species. *H. viridescens* is twice the bulk of this little beetle and has well-developed thoracic tubercles and longer antennæ.

Length  $1\frac{7}{8}$ , breadth  $\frac{7}{8}$  line.

Pipiriki, Wanganui River.

Mr. Hudson sent me a specimen under the number 405.

*Hybolasius gracilipes*, sp. n.

*Elongate*, subopaque, pitchy red, legs and antennæ castaneo-rufous; sparingly clothed with depressed, but not short, yellowish pubescence, the legs and antennæ with long upright white hairs.

*Antennæ* slender, longer than the body; basal joint moderately stout but not clavate and rather elongate; third and fourth long, so that the latter reaches backwards to the hind thighs. *Thorax* subquadrate, rather narrower in front than it is behind, with a small obtuse nodosity at each side not far from the base; its surface is a little uneven and apparently densely punctate-granulate. *Elytra* oblong, rather closely and moderately coarsely punctured, they are wider than the thorax at the base, with obtusely rectangular shoulders, there is a pair of small nodosities near the base, the central portion appears somewhat depressed, but there are no distinct elevations besides the basal ones; the pubescence though irregularly distributed does not form spots, the apices are infusate red and closely punctured.

In some respects this species resembles *H. gnarus*, but its clothing is more conspicuous, its legs are more elongate and slender, the thorax is slightly shorter, the humeral angles and elytral elevations are more prominent, and the coloration is brighter.

Length  $2\frac{1}{4}$ , breadth  $\frac{3}{4}$  line.

Pipiriki.

From the same source as the preceding species and bearing the same number.

*Hybolasius genalis*, sp. n.

*Elongate*, subopaque, piceo-rufous, antennæ uniformly infusate red, legs rufescent, the *tibiæ* blackish towards the extremity; pubescence variegated.

*Head* as wide as the front of thorax, closely sculptured, with a distinct inter-antennal channel, its pubescence yellow; within the emargination of the eye, and on the gena behind it, there is some adpressed brassy pubescence. *Thorax* rather broader than long, with an obtuse but distinct tubercle at each side behind the middle, the basal region therefore seems constricted; the disk is not flat, it is closely punctured, and its clothing is like that of the head. *Scutellum* small. *Elytra* parallel-sided to within a short distance of the apices, wider than the thorax at the base, with two small obtuse prominences there, their punctuation appears to be irregular and is not easily detected; their surface is rather thickly covered with yellowish-grey decumbent hairs, but on the apical portion there are about a dozen bare small reddish spots, and between the posterior femora there is a broad fuscous fascia which almost forms two sides of a triangle. The *legs* bear upright grey hairs and the thighs are clavate; the tarsi are dark brown. *Antennæ* elongate, basal joint stout but not clavate, with yellow pubescence; joints 3 and 4 about equally long and slender.

*H. fasciatus*, No. 1321, though somewhat similar as regards markings, is a broader and flatter insect, with a more transverse thorax, much less prominent lateral tubercles, and more acutely rounded elytral apices, and, moreover, it lacks the distinctive ocular and genal pubescence of the present species.

Length  $1\frac{3}{4}$ , breadth  $\frac{5}{8}$  line.

Pipiriki.

One individual kindly forwarded by Mr. G. V. Hudson, also labelled No. 405.

### Group *Cryptocephalidæ*.

#### *EUALEMA*, gen. nov.

*Antennæ* elongate, filiform, inserted close to the front part of the eyes; basal joint stout, curvate, second half the length of the third. *Eyes* large, transverse, thicker below than above, but not quite reniform. *Femora* simple. *Tibiae* without spines, grooved at the extremity only. *Tarsi* with triangular basal articulations, second rather shorter and more slender at the base than the first, third transverse, not at all lobate but slightly excavate above, fourth slender and elongate, the hind tarsi nearly similar. *Claws* appendiculate or thickened at their basal half.

*Head* immersed up to the eyes. *Thorax* strongly transverse, being twice as broad as long, posterior angles rectangular, the anterior obtuse but prominent, apex widely incurved. *Scutellum* distinct, triangular. *Elytra* ample, broader and five times longer than thorax.

Notwithstanding evident discrepancies, this genus should, I think, be located near *Alema* in the New Zealand list. The structure of the underside in the only mounted specimen extant cannot, at present, be ascertained.

*Eualema Walkeri*. sp. n.

*Suboblong*, convex, nude, variegate, shining; head and thorax irregularly fusco-testaceous; elytra testaceous, but with a small detached spot on each shoulder, a broad oblique space extending from each of these to the suture, an irregularly formed mark at each side reaching from the shoulder to just beyond the hind thigh, and a large space on the posterior declivity glossy æneo-fuscous, all these marks of more or less ragged outline, but always conspicuous; legs testaceous, but with a dark spot at the base of each tibia.

*Head* finely and rather indefinitely punctured. *Antennæ* finely pubescent, basal four joints piceous, but with the base of each quite red, the others are nearly ferruginous. *Thorax* very slightly uneven above, moderately finely and irregularly punctured, finely margined throughout, its sides not quite straight, being widest at the middle and a little narrowed towards the front and base. *Scutellum* smooth. *Elytra* wider than thorax at the base, the humeral angles rounded, their sides very little curved, the posterior portion sinuously narrowed so that the obtuse apices appear prominent: they are not striate, but bear series of fine punctures; these, however, are almost entirely absent from the dark polished lateral and apical marks.

Length 4, breadth 2 lines.

Westport.

This is without doubt the most conspicuous of the New Zealand Phytophaga. I have named it after its discoverer, Mr. J. J. Walker, F.L.S., of H.M.S. 'Ringarooma.'

Auckland, N.Z.,  
16th Sept., 1902.

V.—Notes on the Natural History of East Finmark. By  
Canon A. M. NORMAN, M.A., D.C.L., LL.D., F.R.S., F.L.S.

[Continued from vol. xi. p. 598.]

[Plates VIII. & IX.]

# POLYZOA (*continued*).

Genus LARNACICUS \*, gen. nov.

Type, *Larnacicus corniger*, Busk. (Pl. VIII. fig. 3.)

*Membranipora cornigera*, Hincks, Hist. Brit. Marine Polyzoa, p. 164,  
pl. xxi. fig. 4, and pl. xxii. fig. 3.

Differs from *Amphiblestrum*: 1st, in the avicularia being situated in distinct and separate cells from the zoëcia (in the type species they vary greatly in size: the larger are long, ovate, contracted near the middle in the position of the complete but easily broken bar; in the smaller the anterior portion is loop-shaped and the posterior a mere slit); 2nd, in the absence of pore-chambers (at any rate, I have not succeeded in seeing any); 3rd, in the remarkable character of the distal end of the zoëcium, which is divided into chambers by a transverse and usually one or two vertical connecting-bars. These chambers most probably are in connexion with the oëcium, which is well raised, globose, and situated over the chamber just described. There are two or three pair of spines, the lower pair forked at their extremity. I illustrate the oëcium, which has not hitherto been figured.

Specimens of this species from 100 fathoms off Shetland, and from the Hardanger Fiord, Norway, are in my collection.

Genus ANTROPORA †, gen. nov.

Type, *Antropora* (*Membranipora*) *granulifera* (Hincks).  
(Pl. VIII. fig. 4.)

*Membranipora granulifera*, Hincks, "General History Marine Polyzoa,"  
Ann. & Mag. Nat. Hist. ser. 5, vol. vi. (1880) p. 72, pl. ix. fig. 4.

Zoëcia triangular or subtriangular, but very irregular in form. Calcareous portion of the area similar to that of *Am-*

\* λάρναξ, a chest or coffer, in allusion to the structure of the anterior part of the zoëcium.

† ἄντρον, a cave or hollow, with reference to the hollow in which the oral opening lies.



*phiblestrum* behind, but here also extending up the sides and round the front, so that the membranous portion is completely surrounded by it, and the calcareous portion sloping inwards and downwards; the membranous portion with the oral opening is situated in a deep hollow. On the distal margin, in the place usually occupied by the oral spines, a pair of avicularia, with their pointed mandibles directed inwards in such a way so that their tips nearly meet in the middle. There are three pair of lateral pore-chambers and several (four usually) lucid spots in the hind wall.

*Antropora* is remarkable on account of the most unusual position of the avicularia transversely situated above the oral opening. Avicularia occur on the sides of the oral opening and sometimes appear above it (as in *Amphiblestrum Flemingii*), but in this latter case they belong to the bottom of the zoecium above; here they are in the extreme upper part of the zoecium. The back of the zoecium is characterized by three pair of conspicuous pore-chambers, and on the anterior part of the back wall, which is more thickened than the portion posterior to it, are at the front two transparent bays, and behind these a pair of round lucid spots, behind which again are sometimes seen two others of much smaller size (fig. 4).

The types were described by Hincks from specimens sent to him from Madeira by Mr. J. Y. Johnson. In 1896 I dredged it not rarely off that island in 70–100 fathoms, encrusting small shells such as young *Pectens*, *Venus mediterranea*, *Dentalium*, &c., and it especially affected fragments of the coral *Madracis asperula*. The polyzoon most commonly associated with it was *Onychocella antiqua*, Busk. These species often grew over each other, and were so curiously alike in general form and appearance that the avicularia of *Antropora* were the available character for separating them with a hand-lens.

Genus AMMATOPHORA \*, gen. nov. (Pl. VIII. figs. 5, 6, 7.)

Type, *Ammatophora* (*Membranipora*) *nodulosa* (Hincks).

*Membranipora nodulosa*, Hincks, Hist. Brit. Marine Polyzoa, p. 170, pl. xx. fig. 9.

Zoecia and oecia depressed and flattened. Zoecia sub-ovate; a calcareous crest occupying about two-thirds of the area. Oral opening at distal end of the membranous portion. Walls thin, terminating at the oecium in a knob. Oecium entirely separable from the zoecium, resting on the knobs just mentioned; of unusual and varied form (see figures).

\* ἄμμα, a knot, and φέρω.



Surface of zoarium with raised nodulous processes. No avicularia. No pore-chambers.

*Ammatophora nodulosa* is a rare species which I have only seen from two localities—in deep water off the Antrim coast, and in about 15 fathoms at Guernsey; in the former case on a stone, in the latter on small valves of *Pecten opercularis*. The living zoarium is covered with a glistening yellowish epitheca, which conceals much of the real structure. The operculum in the Guernsey specimens is simple and the margin but slightly thickened; in the Antrim specimen it is more highly chitinized, in form of half a circle, with the lower corners slightly turned out. The nodulous processes consist generally of one at the bottom of the zoecium or of two at the angles of the bottom. The oecium rests upon, but is not firmly united with, the knob which terminates the side wall of the zoecium. It is very difficult to understand the different forms which the oecium assumes, and which will be better understood from the figures (figs. 5, 6, 7) than from any description. The figures and generic characters are drawn from specimens which have been boiled in liquor potassæ, and thus the epitheca have been removed. Hincks's drawing represents the zoarium in its natural condition. This is a very curious species; in the process of boiling some of the oecia entirely separated themselves from the zoecia, and that without any fracture. The granulated knob at the summit of the side walls, and the knobs of the oecium which rests upon it, forcibly reminded me of the limb-joints in the human body!

#### Genus ROSSELIANA, Jullien.

*Rosseliana*, Jullien, 'Mission Scientifique du Cap Horn, 1882-1883,' 1888, p. 79.

Type, *Rosseliana (Flustra) Rosselii* (Audouin).

*Membranipora Rosselii*, Hincks, Hist. Brit. Marine Polyzoa, p. 166, pl. xxii. fig. 4.

There are two, more rarely three, pair of lateral pore-chambers and one large distal one—this last sometimes divided into two or three; but the chambers do not project beyond the breadth of the walls. In a specimen coating the inside of a shell of *Pecten opercularis*, in that part which was attached to the wavy portion near the edge of the *Pecten*, the back wall of the zoarium was much thickened and every zoecium was separately marked out (*i. e.* higher in the middle and sloping at the sides); and each bore about three pustules

(? rosette-plates), the appearance of which was exactly that of those figured as characteristic of the genus *Steganopora* (see d'Orbigny, Paléont. Franç., Terr. Crét. pl. dccxxi. figs. 3, 7, 11; and Jullien, "Les Costulides," Bull. Soc. Zool. de France, 1886, pl. xvii. fig. 2 and pl. xix. fig. 2).

*The Zoecium-building in Cribrilinidæ.*

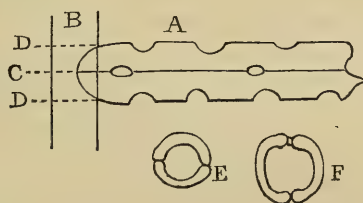
In describing the structure of *Lepralia* (*Membraniporella*) *nitida*, Hincks wrote that "in its earlier condition it closely resembles one of the spiniferous *Membraniporæ*. The ribs of the adult state are represented by suberect spines set round the margin. As growth proceeds the spines bend inwards and increase in size, and gradually take on the flattened rib-like appearance. After a time the opposite rows meet in the centre of the cell-area, and the extremities, which are often enlarged, are soldered together, so as to form a well-marked median line. In some instances the ribs unite laterally to a great extent, and the front becomes a solid wall. In others they continue quite separate." In his account of *Cribrilina annulata* he writes:—"In its earliest stage the zoecium exhibits the simple *Membraniporidan* form—the area occupying the entire front and being closed by a membranous covering. The ribs which compose the frontal wall in the adult are given off on each side as tubular processes from the edge of the nascent cell, and, gradually lengthening, meet in the centre and unite, the line of junction giving the subcarinate appearance of the zoecium. These tubular girders, which are probably the equivalent of the marginal spines on many of the *Membraniporæ*, are connected at intervals by lateral outgrowths of calcareous matter; and in this way the porous structure of the furrows is produced. The mode of formation may be well studied in the thickened anterior margin of the orifice, which is composed of two tubular pieces, the pointed extremities of which in meeting often bend outwards and give rise to the central mucro. Sometimes they are not closely welded together, but overlap one another or remain partially separate, so as to give a bifid appearance to the mucro. Occasionally they do not unite at all, but continue permanently free and detached."

All this is in every particular correct as regards the two species referred to; and the description of *Cribrilina annulata*, of course, was intended to be applicable in a general sense to the whole of the species which he placed in Gray's genus *Cribrilina*. My object in the following notes is to go into the question more minutely, for the purpose of showing

how the process of modification takes place and the various forms are developed. As all the species cannot, in my opinion, remain in the two genera to which Hincks assigned them, I prefer to refer to them simply by their specific names.

The majority of the Cribrilinidæ are furnished with pore-chambers, but the following are without them:—*melolontha*, no pore-chamber and only two rosette-plates on the whole side; *nitido-punctata* and *figulina*. *Nitida* has two pair of large lateral pore-chambers and one distal, the last sometimes being divided into two. In *annulata* Levinsen has figured (Zool. Dan. pl. v. fig. 24) the pore-chambers as very irregular, one lateral pair and one or two distal, or two pair lateral, the former of which meet in the middle of the distal margin, and I have seen the same variations in British specimens; but in the var. *spitsbergensis* I have not seen any pore-chambers in the example treated with liquor potassæ, the side walls are narrow and possibly the underlying pore-chambers have been destroyed in the preparation: *radiata* and the form *innominata* have four pair of lateral pore-chambers and one (or two) distal; *punctata* has three pair lateral (and two distal?); *cryptoæcium* has three or four pair lateral and two distal; *Balzaci* has four pair lateral and *Gattyæ* three pair lateral.

The cribriline portion of the front wall in Cribrilinidæ is built up by bars, which would seem to represent the spines of the so-called "Membraniporidæ." The diagrams annexed indicate the process of development. The bar A always has



its proximal end rounded, and this rounded end I shall call the *loop*, C: in most cases the loop has its origin in the *side wall*, B, in the same manner as a spine; but in certain species, as *Gattyæ*, *Balzaci*, and *figulina*, in which the areolated or cribriliform portion only occupies the central part of the front wall, and is separated from the side wall by a considerable unsculptured interval, the "loops" have their origin in the front wall and not in the side. The bar is hollow, and in

such a species as *nitida* this hollow or *lumen* is very manifest ; but in most cases the lumen is only indicated by a line seen along the centre of the bar, which, whether actually visible or not, may be called the *lumen-line*. On this lumen-line there are often openings into the lumen, which may be called *lumen-pores* (see woodcut, line of C), at other times calcareous matter is heaped up along the lumen-line, so that a strong *rib* is formed. The side of the bar may be called the *lateral line*, and the poral openings usually developed upon it may be styled *lateral lacunes*\*, and those at its extremity *median lacunes*.

The great peculiarity in the structure of this group consists in the curious fact that, while the openings along the centre of the bars are simple pores or openings into the lumen, no *lacune, whether lateral or distal, is ever formed without the combined assistance of two adjacent bars*; and indeed in the posterior portion of such a species as *Gattyæ*, where several bars meet at one point, at that point three, or even four, bars seem sometimes to contribute to the building up of the circle of a single very small lacune. In the woodcut the semicircular hollows which break the lateral lines indicate the portion of as many lacunes which that line contributes to form, and similarly the two distal hollows indicate the share which this bar takes towards the structure of two of the median lacunes, the remaining portion of which will be supplied by a bar or bars which have their origin in the opposite wall of the zoæcium. A lateral lacune therefore consists of two parts divided horizontally (see E), owing its origin to the lateral walls of two adjacent bars ; while a median lacune consists of two vertical portions contributed by the distal extremities of two opposite bars F.

The Cribrilinidan zoëcia which are figured and described here were thus treated :—After being boiled in liquor potassæ they were again boiled in water, the water poured off, and the shell or stone dropped into cold water, when the zoarium often at once detaches itself ; and if it should not a slight pressure with a scalpel at its edge will often suffice to dislodge it. If this does not succeed the shell is held against the side of the flame of a spirit-lamp in such a way that the surface opposite to that to which the zoarium is attached is in contact with the flame, and the shell, when it is extremely heated, is suddenly dropped into cold water, when the zoarium is usually liberated ; in obstinate cases the heating has to be repeated.

I undertook the following investigations from the desire

\* *Lacuna*, a space not filled up.



to thoroughly understand the way in which *C. nitido-punctata* assumed its unusual form, and this led on to the examination of the entire family.

*Nitida* (Pl. VIII. fig. 8).—Three bars are here represented. It will be observed that they are of irregular form, the exact character of which is decided by the necessity of forming distal junction with their collateral and opposite neighbours: the line of junction in this particular species has a waved zigzag character. *The bar at its commencement in the side wall is a rounded loop.* This is the first point of great importance to note because the *existence of such a loop in the side or front wall of ALL Cribrilinæ* leads us to understand the building up of the zoëcium in some obscure cases. The second point of primary importance is the presence of a very large lumen, which here occupies the whole of the interior of the bar. In some forms we find that this lumen is only indicated by a fine central line, or by the presence in that line of a minute pore; or all trace of it may be obliterated by the overgrowth of a rib, which is raised over the lumen-line.

*Melolontha* (Pl. VIII. fig. 9).—The character of the bars is similar to that of *nitida*. In the first bar which is drawn there will be noticed a tendency of the lumen to divide and form a fork. In other species it will be found that this is carried further.

*Annulata* (Pl. VIII. fig. 10).—The figure given is drawn from an unusually simple form of the species \* living on a frond of *Laminaria*, but has some special characteristics. The bars are only loosely attached and not cemented together; and on boiling in liquor potassæ the zoëcium in many cases broke up, the bars separating. The lacunes between the bars in the zoëcium illustrated are the result of the simple contact of two bars here and there, and each bar retains its own strongly marked margin; and thus we have the earliest and simplest mode of formation of these lacunes, in the producing of which two bars always take part. The bars themselves, which in this specimen are more flattened than usual, have the appearance, at first sight, from their opacity and brownish colour, of being solid; but closer inspection reveals a pellucid circle in the loop of the bar within the marginal line of the zoëcium which indicates the end of the lumen, while at the distal end of many of the bars there is a small pore, and the conviction becomes almost a certainty that a lumen fills the whole bar except the narrow marginal line. The ordinary

\* Kindly given me by Dr. Harmer; he procured it at Godösand, off Tysnäsö in Björne Fiord, Norway.



British forms of this species, as will be seen by reference to the figures of Hincks (pl. xxv. figs. 11, 12), come much nearer to the following Arctic variety, except as regards certain points which will be referred to when I come to describe that variety.

*Annulata*, var. *spitsbergensis* (Pl. VIII. fig. 11).—Here the bars are closely consolidated together, the elevated ribs indicate the bars, and along their middle a faint line may be noticed with occasionally a very minute pore which makes known the existence of the lumen below; lines of lateral lacunes occupy the junction of the two adjacent bars, and are formed, as always, by their joint participation in the manner which has been already described.

*Nitido-punctata* (Smitt) (Pl. VIII. figs. 12, 13).—This beautiful species possesses some very distinctive characters and variations from the more normal forms, which are of much interest. The bars (see fig. 13, which represents some bars in the middle of the zoëcium) are at first narrow and widely separated, so that, instead of ordinary lacunes, there are entirely open spaces between them; at about three-fifths of the distance to the middle line the bar widens and forms half an arch on each side to be met by half an arch from the neighbouring bar to complete its formation at *b* and *c*, from the points indicated by these letters the bar is projected straight forward until it meets the median line of the zoëcium *d*, forming on its way, with the assistance of the adjoining bar, a lacune; the figure given represents a pair of completed lacunes, which are divided by the median line, and belong the one to two bars proceeding from the left, and the other from two bars proceeding from the right side of the zoëcium, and below these is seen a pair not fully formed. It might have been supposed, at first sight of their position in the middle of the zoëcium, that these were median lacunes, but that is not so—they are lateral lacunes, horizontally divided. A line is over the lumen at *a*, and has usually two small pores, one of which is in the loop and the other beyond the division into the half-arches. Fig. 12 represents the building up of the bridge and the oral lip. The bar *a* bifurcates and the lumen shares the bifurcation and has three pores, one at the base in the loop and the other at the end of the lumen in each branch of the fork; the lower branch of the fork is on the same level as the rest of the zoëcium, the upper branch of the opposite bars is projected upwards and outwards, and joining leave below them a large open foramen, which they overhang, and on them the solid outspread bars *b* are attached, forming in front the lower lip of the oral

opening and leaving at the sides behind large lateral foramina, *d*. The foramen *c* is ordinarily so much overhung by the arch formed by the upper portions of the forked bars *a* that it is hidden when the zoëcium is viewed from the front (see the figure of Smitt), but, so far as my observations go, it is never closed; and doubtless serves some special function.

*Punctata*.—The lacunes are ordinarily unusually large, and they are all lateral lacunes: for median lacunes are rarely present, the median line being occupied by a ridge running down the centre of the zoëcium and developed on the distal meeting-line of the bars. The lumen seems always to have a pore of somewhat larger size than usual just beyond the expansion in breadth in the loop; and sometimes a second minute pore much further in. Sometimes the lumen-line is occupied by an elevated ridge (see Hincks, pl. xxvi. fig. 4), and these bar-ridges unite with the central longitudinal ridge as in Hincks's figure, but in other cases they die out before they reach that ridge. One pair of bars takes part in the formation of the lower lip, and while its hinder margin contributes its share to the formation of the foremost row of lacunes, its front margin constitutes the lower lip, and the lumen-line is usually raised in the form of a rib; the inner front corners of the bars are either cemented together and produce a simple rostrum, or they remain ununited at the tips and constitute a bifid rostrum; both these forms of the rostrum are shown in Hincks's pl. xxvi. fig. 1. In this species the oëcium is globose and somewhat elongated; it remains permanently exposed, but is subject to nodulous outgrowths, and frequently bears an avicularium on its summit (see Hincks, pl. xxvi. fig. 4). I have in my collection an interesting specimen in which many of the zoëcia, as well as the tuberculated oëcium with its avicularium, closely agree with the figure just referred to with the following important additions: there is a pair of lateral oral avicularia the direction of which is perfectly horizontal and the raised lumen-rib has at its base a large pore (as in *Cribrilina hippocrepis*, Hincks, "Polyzoa Queen Charlotte Islands," Ann. & Mag. Nat. Hist. ser. 5, vol. x. 1882, pl. xx. fig. 6) and often a second more distal smaller pore; in some zoëcia there is only one lateral lacune (as in the figure of Hincks, Brit. Pol. pl. xxvi. fig. 4), but in other zoëcia there are two.

*Cryptoëcium*, sp. n. (Pl. IX. figs. 1, 2).—The building up of the zoëcium is of the same character as in *punctata*. There are usually not more than four large lacunes on the whole breadth of the zoëcium, nor more than five bars on a side;

and as the posterior rows never have so many lacunes, fourteen may be considered the usual full number.

*Radiata* and the species or variety *innominata* (Pl. IX. fig. 3, *innominata*).—In these forms the bars in the youngest state have a pore in the loop, but soon afterwards the lumen-line is raised into a more or less prominent ridge, and the pore is commonly obliterated. The lateral lacunes are generally three or four in number: there are usually no median lacunes, their place being occupied by a longitudinal central rib, which is evident at an early stage of development, and to the sides of which the lumen-ribs commonly afterwards unite themselves. The oral opening is formed much in the same way as in *nitido-punctata*, but in a more simple manner: the lower bar does not fork as in that species, but its front margin is outspread at the sides until it unites with the oral bar, but leaves in the middle a single large lacune. The form *radiata* differs from the *innominata* which I have just described in having more numerous bars, more numerous lacunes, with a few median lacunes occasionally to be seen; the lumen-ribs are only slight, the longitudinal rib seldom developed. The junction of the oral and suboral ribs, instead of leaving only one large central lacune, is indicated by from one to seven lacunes; though it is seldom that the number is confined to the single lacune characteristic of *innominata*, and I have only seen such instances of single lacunes in this position in the case of a zoecium here and there in a zoarium. The *radiata* forms which I have examined are from Birturbuy Bay, Ireland, Guernsey, Naples, and Madeira. A very beautiful form of the variety *innominata* occurs at Guernsey, all the ribs are very much raised, the central longitudinal rib rises in front to a much elevated process; but the chief peculiarity consists in spine-formed hollow processes which rise above the base of the lumen-ribs just over the place where in the young is seen the lumen-pore, and from which they doubtless take their origin. I have now described the ordinary cribriline structure in these two forms. But an entirely new feature appears here. Hincks described a "very delicate setiform appendage" as developed on each side of the lower margin of the orifice, and in his description of the plate called these organs "vibraculoid setæ." Dr. Harmer has recently ("On the Morphology of the Cheilostoma," Quart. Journ. Micr. Sci. vol. xli. n. s. 1902, p. 326, pl. xv. fig. 7) traced the matter further, and found these appendages in reduced size present also at regular intervals along the side of the zoecium. Dr. Harmer is of opinion that they not only represent the spines of the ancestrula, which he figures, and that "the



base of each papilla is a pore in the calcareous front wall"; but he adds: "It has usually been assumed that the radiating series of pores correspond with slits between the bars; but in *C. radiata* there can be no doubt that the pores are in the same radii as the membranous marginal spines." "The lateral junctions of the frontal bars are indicated by prominent radial ridges, each of which rises to a small tubercle just inside the line of the membranous papillæ above described. The pores consequently lie, as described by other observers, in radiating furrows. That the union between the bars has not been complete is indicated by the fact that a thin line of air in some cases underlies the ridge." Thus Dr. Harmer considers that this particular form totally differs from ordinary Cribrilinidæ in that the line of lacunes is here the centre of the bar, and that the ribs are its sides. My own conclusion is different. I regard these papillæ as really in the line of junction of the bars. It is my endeavour to show in these notes that all the different Cribrilinidan forms depend upon the different structural building up of the bars which we first meet with in their simplest form in *Lepralia nitida*, and that the bars may be invariably recognized by their basal loop, which usually has its origin in the side wall; but in cases where the Cribrilinidan structure occupies only the central part of the front wall the loop of the bar will be found buried in that front wall. If the illustration (Pl. IX. fig. 3) which I have given of a portion of the front wall of *innominata* be now referred to, it will be seen that three bars are represented with their basal loops situated in the side wall, that at the inner end of the loop there is a minute pore, and a line passes down the centre of the bar indicating the lumen beneath\*. Between the bars (that is, at their junction) is the usual line of lacunes; between the loops of the bars, and excluded from the normal Cribrilinidan structure by the fact that the arch which connects the bars passes inside them, are the papillæ (*a*, *b*, &c.), which are thus in the line of, but really outside of the junction of the bars which form, the lacunes. If an opening (*c*), from which the papilla has been removed, be examined it will be found to be inside of the side wall, and that it is directed inwards and downwards so as to pass into the body-cavity. Now if the bars and their lumen represent the spines of what have been called Membraniporidæ, and if the lacunes with the line which passes through them be the junction-line of two adjacent bars, then these papillæ cannot represent the spines. What are they then? Their resistance in boiling liquor potassæ

\* The "thin line of air" which Dr. Harmer observed was, in my opinion, in this lumen.

seems to prove that they are of chitinous structure, which does not militate against the view entertained of them by Smitt, who, writing of what he termed the "pair of movable bristles," says: "as to their use, they seem to represent sensorial vibracula. Very often they are laid down along the side of the zoëcium" ('*Floridan Bryozoa*, pt. ii. 1873, p. 22). They, at any rate, appear to be entirely independent structures; and I trust that Dr. Harmer may have an opportunity before long of throwing further light upon them. These organs are not confined to *radiata* and its variety *innominata*; they are present also in *M. Gattyæ*, and also in *figulina*, where they are represented in a similar position between the loops of the bars by small slits; but though I have seen these openings, I have only seen the papillæ themselves in *radiata* and its variety and the frontal pair only in *Gattyæ*.

*Gattyæ*.—The figure given (Pl. IX. fig. 4) will by itself, after what has been already written, explain the structure in the form which is usually found on red seaweed. Pl. IX. fig. 5 is taken from a form encrusting a shell taken in Guernsey. In this the papillæ-holes can be made out down the sides, while in the red weed specimen it was only the first which I could distinguish plainly. The former has a remarkable peculiarity, the minute lacunes on the marginal line are in pairs, which is a unique feature; the margin of each bar appears to make a loop and then the interval between them is filled in. The number of lacunes from the margin to the centre is, moreover, double that of the other and more usual form of *Gattyæ*. It may prove to be a distinct species.

*Balzaci* (Audouin), Waters, = *cribrosa*, Waters *olim*, from Madeira (Pl. IX. fig. 6), has usually only one large lacune on the marginal line and some minute lacunes round the middle.

*Figulina* (Pl. IX. fig. 7) has a very simple structure. A row of comparatively small lacunes occupies the lateral line and runs right up to the median line, and there is a total absence of median lacunes. The lumen-line has a remarkably large pore in the loop, and between these large pores and a little exterior to them there is a small, elongated, narrow pore. I have figured this last pore as exterior to the Cribri-linidan system, and in the place of the papillæ-pores of *radiata*, and I think that I have done right in doing so; but I do not feel quite certain upon the point, the thickness of the shell in this species makes it difficult to trace the exact outline of the loops of the bars; but, as well as I have been able



to determine, that margin passes inside and not outside of these little elongate pores.

This species is, I think, entitled to generic rank; the character of the front wall, with the Cribrilinidan portion not extending to its margin, and the peculiar facies of that portion, the vicarious avicularia, the well-developed operculum, and perhaps, above all, the processes on the side of the oral opening for the hingement of the operculum, seem to point to the reasonableness of adopting Jullien's genus *Figularia* to receive it; and the same author's genus *Puellina* (type *P. Gattyæ*) might be adopted for those species which are furnished with lateral papillæ.

### "LEPRALIA."

When Johnston (Brit. Zooph. edit. i. 1838, p. 277) instituted the genus *Lepralia*, after stating that *Berenicea*, Fleming, had been previously employed, he added: "Milne-Edwards names the genus '*Escharoides*,' but neither this nor *Escharina*, another of his names, can be adopted, since some naturalists use the terminations *-oides* and *-ina* as family appellations. Moreover, what saith Linnæus? 'Generic names including other generic names are unworthy of a scientific nomenclature.' And, again, 'Generic names in *-oides* are prohibited' (see Young's Med. Literature, p. 28)." Here is his reason for giving a new name to his genus. It was a valid reason at the time, though not according to more recent usage. *Lepralia* is a name so old and so familiar that it can hardly be dropped as a synonym; and it would scarcely be justice to Johnston to omit its use. In what sense, then, must it be employed? Here comes in no small difficulty. It is a primary law of nomenclature that some species which Johnston placed in it when he instituted the genus must be the type. The species thus included were as follows:—*L. hyalina* (Linn.), *nitida* (Fleming), *coccinea* (Lamk.), Johnston, *variolosa*, Johnston, *ciliata* (Pallas), *trispinosa*, Johnston, and *immersa* (Fleming). The name used as Smitt and Hincks employed it is not *Lepralia*, Johnston; and the definition of Hincks excludes from it all Johnston's species. As Jullien has written\*: "Genre *Lepralia*, Th. Hincks (not Johnston, 1838), 1880.—Cet ancien genre de Johnston a été entièrement bouleversé par Th. Hincks, et ne devrait plus exister aujourd'hui." Of the species which Johnston placed in his *Lepralia*, *hyalina*

\* Miss. Scient. Cap Horn, Bryozoaires, 1888, vol. i. p. 57.

belongs to the earlier genus *Hippothoa*, Lamarck, and *coccinea* is the type of the earlier genus *Escharoides*, Lamarck, as settled by Gray. Gray instituted a genus *Escharella*, to which he removed *variolosa* and *immersa*; and Hincks established three new genera, in which he placed the three remaining species *Membraniporella nitida*, *Micro-porella ciliata*, and *Smittia trispinosa*. We have seen that Johnston's *L. hyalina* has its place in the earlier described genus *Hippothoa*; the second species in his work was *Lepralia nitida*, and I would suggest that that species be regarded as the type of his genus.

#### Genus LEPRALIA, Johnston.

= *Membraniporella*, Hincks (nec *Lepralia*, Smitt, nec *Lepralia*, Hincks).

Type, *Lepralia nitida*, Johnston.

#### 39. *Lepralia nitida*, Johnston. (Pl. VIII. fig. 8.)

Nordkyn (*Nordgaard*). I have not myself seen any specimens of this species from Norwegian or Arctic seas; nor would it appear that Smitt had met with it, since the only localities he gives are Britain and Bahusia. The record of this species, therefore, in East Finmark extends our knowledge of its range very considerably.

#### Genus GEPHYROTES\*.

Type, *Gephyrotes (Cribrilina) nitido-punctata*, Smitt.

Bars narrow, and widely separated more than halfway to the central line, leaving broad open intervals between them, then bending to either side they unite with the adjoining bars forming thus a regular arch, beyond this are large lateral lacunes, few in number, no median lacunes usually developed. The foremost bar but one is forked, the lower limbs of the opposite forks uniting transversely across the zoëcium, the upper limbs directed upwards and forwards and then uniting, thus leaving a large opening below. Oral bars large and solid, resting, as regards their central portion, on the upper limbs of the fork behind, and in front forming the lower lip of the oral opening, and at their sides below two large openings, but these are not equal in size to the central opening already mentioned; the bridge thus formed by the foremost bar and the front members of the second bar is projected outwards and overhangs the rest of the zoëcium in such a way that the large central opening is often concealed from sight when the zoëcium is viewed from the front.

\* γεφύρωτής, a bridge-builder.

A pair of avicularia with mandible pointing upwards are often developed on the side walls of the oral opening. Ooëcia subglobose and imperforated. No pore-chambers.

*Gephyrotes nitido-punctata* (Smitt). (Pl. VIII. figs. 12, 13.)

1868. *Escharipora figularis*, forma *nitido-punctata*, Smitt, "Kritisk Förteckning, &c." p. 4, pl. xxiv. figs. 2, 3.

1873. *Cribrilina nitido-punctata*, Smitt, Floridan Bryozoa, pt. 2, p. 22.

1895. *Cribrilina nitido-punctata*, Nordgaard, Bergen Mus. Aarbog, 1894-95, p. 19, pl. iv. fig. 3.

The type specimens of this fine species described by Smitt were taken by Lovén in 40-60 fathoms at Hammerfest. Examples in my own collection are from the Bergen Fiord, where I found it to be not uncommon in 1878, and West Greenland, 'Valorous,' 1875 \*. Nordgaard has also recorded it from the Trondhjem Fiord.

#### GENUS CRIBRILINA, Gray.

Type, *Cribrilina punctata* (Hassall).

Gray in instituting this genus placed only one species in it, namely *Lepralia punctata*, Hassall, which, therefore, must be the type of the genus. Yet, notwithstanding this, Hincks, in his paper "On the Classification of the British Polyzoa" (Ann. & Mag. Nat. Hist., Feb. 1879), substituted "*Cribrilina*, Gray. Type, *C. radiata*." The next step to confusion was taken by Jullien, who, in his paper on "Costulides" (= Cribrilinidæ), instituted a large number of genera, and, describing *Cribrilina*, followed Hincks in making *C. radiata* the type, and then gave to that genus characters which would exclude the true type, *C. punctata*, from it! Such is the unfortunate result here, as in so many other instances among the Polyzoa, of the disregard of the simplest laws of nomenclature!

*Cribrilina punctata*, Hassall.—I have already noticed some of the variations in the structure of the zoëcium of this species. The zoaria are of small size, rarely reaching as much as half an inch in diameter. The avicularia, when developed, are usually only on one side of the oral opening, rarely on both sides. Oral opening with lower lip not greatly thickened but generally centrally produced, often acutely so. Oral spines four. In cells bearing ooëcia two lateral spines often remain and attain a great size, arching forwards and upwards. Ooëcium large, globose (see Hincks,

\* On the same stone with a specimen of this species was also *Rhabdopleura Normani*, Allman, a genus which is an interesting addition to the fauna of Greenland.

pl. xxvi. fig. 1), and frequently carrying an avicularium at its summit.

Specimens of *C. punctata* as here restricted are in my collection from Naples; Salcombe, Devon; Birturbuy Bay, Ireland; Wick, 40 fathoms; Shetland, including the largest zoëcia I have seen of the species, from 120 fathoms; and Nantucket, N.E. America.

40. *Cribrilina cryptoëcium*, sp. n. (Pl. IX. figs. 1, 2.)

1867. *Escharipora punctata*, Smitt, "Kritisk Förteckning, &c." p. 4, pl. xxiv. figs. 4-7.

1880. *Cribrilina punctata*, Hincks, Hist. Brit. Marine Polyzoa, p. 190 (*partim*), pl. xxiv. fig. 3, and pl. xxvi. fig. 3.

1894. *Cribrilina punctata*, Levinsen, Zool. Dan., Mosdyr, p. 61, pl. v. figs. 13-18, &c.

1900. *Cribrilina punctata*, Waters, "Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 62, pl. viii. fig. 22.

Front wall with lacunes of considerable size, arranged in transverse rows, not usually more than four in a row, between the marginal lacunes riblets may or may not be developed in young zoëcia on the lumen-line of the bars; lower lip of oral aperture considerably pouting outwards and unusually thick; in the centre at the junction of the bars the mucro may be single or double. No central longitudinal keel. Oëcia in quite young cells with a strong frontal arched rib, behind which the oëcium itself lies at a lower level. Lateral avicularia with mandible pointing upwards and slightly outwards, almost invariably present on both sides of the oral opening.

Such is the character of zoëcia just built up at the edge of the zoarium. Only a few cells further in it will be found that the whole oëcium, except the front arched rib, has been hidden and buried under the nodulous growth of what Levinsen would call a "kenozoëcium," and which seems to be representative here of the avicularium often developed in the same situation in *C. punctata*.

In old zoaria overgrowth has taken place in a very remarkable manner, which, when fully developed, is only faintly realized in such a drawing as my fig. 2. The appearance assumed is extraordinary. The most prominent feature is the great massive under lip, above this is the strongly developed front rib of the oëcium, above this again another transverse rib (sometimes divided across the middle into two), which is the outgrowth of the kenozoëcium over the oëcium concealed below. Then all the lumen-lines of the bars have been raised into ribs of such a size that the lacunes are almost entirely hidden between them.



The very different characters of the oecium and the remarkable overgrowth are the most prominent of the distinguishing characters of this species, when compared with *C. punctata*, with which it has hitherto been confused. It is of much more vigorous growth than *C. punctata*; zoaria usually exceeding half an inch in diameter and in some cases one inch. It would seem to be essentially a littoral form. In East Finmark I found it between tide-marks, at Vadsö on stones and on the shell of *Buccinum grænladicum*, var. *nuda*, Norman; and it is no doubt this form which Nordgaard has recorded as *C. punctata* from Nordkyn. I have the species also from Guernsey (tide-marks); Birturbuy Bay, Ireland (tide-marks), Hebrides and Shetland (both tide-marks); Bergen Fiord, Norway, 1878, and Svolvær, Lofoten Islands, 1890.

41. *Cribrilina annulata* (Fabricius). (Pl. VIII. fig. 10.)

Mehavn, East Finmark (*Nordgaard*).

Figures 8 and 9 of Smitt represent a simple form of this species; although not so primitive a variety as that of which I have represented some bars. The labial mucro is sometimes present, sometimes absent; when it is present it appears, usually at any rate, to be the termination of a central longitudinal keel of the zoecium, which keel may be entirely absent or more or less prominent. Smitt figures only a pair of lateral oral spines, but besides these there are ordinarily one or two distal spines (see Hincks, pl. xxxv. fig. 11); the lateral lumen-ribs are either well pronounced, as in the figure just referred to, or very conspicuous, as in Hincks's fig. 12. I have not seen any specimen in which they are so few in number, so strongly developed, and all converging forwards as in Smitt's fig. 10. The ordinary oecium is represented in Hincks's fig. 12, having the lateral spines uniting and forming an arch in front of the oecium, but these spines are often taken up by and built more completely into the frontal wall of the oecium.

Var. *spitsbergensis*, nom. nov. (Pl. VIII. fig. 11.)

1900. *Cribrilina annulata*, Waters, "Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 64, pl. viii. fig. 21.

The form which Waters has figured in the paper quoted above as occurring in Franz-Josef Land is a very marked one, and worthy of a distinctive name. The zoecia are about double the usual size, rather flat, without central keel; the series of riblets and pores eight or nine; the oral



spines are replaced by short flattened plates; the oöcium is much larger than in the type, semiglobose, sparingly punctate, with a longitudinal keel; in fertile zoöcia the flattened plates just referred to do not nearly meet in the centre of the oöcium, but form two outspread wings overhanging the oral opening.

I am not sure that this should not be regarded as a species rather than a variety; Mr. Waters gives the locality of the Jackson-Harmsworth specimen as off a glacier between Cape Flora and Cape Gertrude, Franz-Josef Land, in about 30 fathoms. The specimens in my own collection are from Gray Hook, Spitsbergen, 90 fathoms (*Smitt*), and off Holsteinborg, Greenland, 57 fathoms ('Valorous,' 1875). It would thus seem not only to be a high Arctic but also a deep-water form, since I also possess the ordinary typical form on shore-weed from both Greenland and Spitsbergen.

J. E. Gray (Cat. Brit. Anim. B. M. pl. i., Centroninæ, p. 148) appears to suggest a generic name, *Microstoma*, for this species. This name can never, however, be employed, since it had previously three times been used for other genera.

#### Genus REPTADEONELLA, Busk, 1884.

In his 'Challenger' Report, Polyzoa, pl. i. 1884, Busk instituted a genus *Reptadeonella*, for the reception of the Adeonean form *Lepralia violacea*, Johnston (= *Microporella violacea*, Hincks). Three years later Macgillivray (Cat. Marine Polyzoa of Victoria, 1887, p. 110) instituted a genus *Adeonellopsis* with *Adeonella distoma* (= ? *Eschara coscinopora*, Reuss) as its type; and this last genus J. W. Gregory ("British Palæogene Bryozoa," Trans. Zool. Soc. vol. xiii. 1893) united with *Reptadeonella*, Busk. But *Adeonellopsis* has a distinct frontal area containing many fimbriated pores, and is a group for which Levinsen, doubtless not remembering Macgillivray's genus, has recently suggested another name, *Lobopora* ("Studies on Bryozoa," Vid. Medd. fra den Nat. Fören. i Kjöbenhavn, 1902, p. 24, separate copy).

The dorsal view of the zoöcium of *Reptadeonella violacea* is very pretty and of unusual interest, for there are not less than twenty-eight radii of alternating colour, darker or lighter, arranged all round the cell, which indicate many passages of communication between the zoöcia.

Of the other British species which Hincks placed in *Microporella*, *Microporella Malusii*, Audouin, has been made by Jullien the type of a genus *Fenestrulina* (Miss. Scient. Cap

Horn, vol. vi. Bryozoaires, i. p. 37), and Levinsen has in his "Studies on Bryozoa" mentioned a new genus *Haplopoma*, to which he proposes to transfer *Microporella impressa*, Audouin.

Genus MICROPORELLA, Hincks, 1877.

Type, *Microporella ciliata* (Pallas).

42. *Microporella ciliata* (Pallas).

Sværholt (Nordgaard).

43. *Microporella arctica*; sp. n.

1869. *Microporella ciliata*, Smitt (partim), "Kritisk Förteckning, &c.," Eftvers. Kongl. Vet.-Akad. Förhand. p. 6, pl. xxiv. figs. 13-16.

Zoëcia of considerably larger size than is usual in *M. ciliata*. In a young condition the whole front wall is brightly glistening and covered with large pores (Smitt, fig. 13); the crescentic suboral pore is scarcely, if at all, larger than the other pores, and often cannot be seen at all. The form of the oral opening is as in *M. ciliata*, and closest examination generally fails to give the slightest evidence of oral spines; yet in the case of a few zoëcia which were situated in a very sheltered position, I have found four or five very delicate spines. The oëcium is globose, and in this early stage of growth is ornamented with radiating riblets; lateral avicularia are very sparingly developed, a large portion of the polyzoary often not exhibiting any at all. The description just given is that of the young zoëcia of a thoroughly healthy colony, but in zoëcia at a little distance from the margin overgrowth rapidly takes place, choking up all the pores and even the crescentic pore, and smoothing over the oëcium in such a way that the polyzoary assumes the aspect of Smitt's fig. 14.

Another form is that represented in Smitt's fig. 16. The adult zoëcia have the surface granulated more or less roughly, the crescentic pore remains open, and the lateral avicularium is very rarely developed.

The first form I have seen only on stones between tide-marks at Vadsö, where it is accompanied by *Cribrilina cryptoëcium*, *Harmeria scutulata*, *Porella minuta*, &c.

The second form was taken by the 'Valorous,' 1875, off Holsteinborg, Greenland, in 57 fathoms, and was also sent to me by Smitt very soon after the publication of his works as "*Porina ciliana forma dura*, Spitsbergen" \*.

\* It must be understood that these specimens were received thus named before the publication of the last part (pt. v.) of his "Kritisk

## Genus DORYPORELLA, gen. nov.\*

Zoëcia with front wall punctated, furnished with a median pore, in front of which is a spine with spatulate or pear-shaped head. Orifice somewhat horseshoe-shaped, being slightly contracted at the sides and the proximal margin quite straight, distal margin spined. Oëcia globose, punctate. Avicularia at the sides of the oral opening.

Type, *Doryporella spatulifera* (Smitt).

44. *Doryporella spatulifera* (Smitt).

1867. *Lepralia spatulifera*, Smitt, "Kritisk Förteckning, &c.," Ælvers. Kongl. Vet.-Akad. Förhand. p. 20, pl. xxvi. figs. 94-98.

1900. *Microporella spatulifera*, Waters, "Bryozoa from Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 87, pl. xii. fig. 6.

This is a very remarkable little species. The mother-cell is short, ovate, with spined margins. In young zoëcia the pore is much larger in proportion than it is at subsequent periods of growth; it is wide open, and the spine rises from its anterior margin; in one instance I have seen this spatulate spine forked at the extremity and of excessive length. At a later period of growth the pore is often covered over, sometimes with a yellow membrane, sometimes with a calcareous lid. The oral opening has four spines, often of great length; in one case the lower spines were forked at the extremity. In older zoëcia an avicularium with oval mandible is placed high up on each side of the oral opening; and in mature specimens the surface of the zoëcium is granulated.

On *Hypothyris psittacea* in Lang Fiord. Other specimens in my collection are from Gray Hook, Spitsbergen, 90 fathoms, on stone (*F. A. Smitt*); "Finmark" (*F. A. Smitt*); Greenland, off Holsteinborg, 57 fathoms, on *Hypothyris* and *Pecten islandicus* ('Valorous,' 1875); Greenland, on *Hypothyris* (from Copenhagen Museum); Gulf of St. Lawrence, on shell (*Whiteaves*). The species would seem to be especially fond of the shell of *Hypothyris psittacea* as its dwelling-place.

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Förteckning, &c." in 1874. In that paper he restricted the term "*forma dura*" to his figure 17, and called it *Discopora cruenta* (Norman). It was not, however, my *Lepralia cruenta*, and Hincks subsequently described it under the name *Monoporella spinulifera* (Ann. & Mag. Nat. Hist. ser. 6, vol. iii. 1889, p. 431, pl. xxi. fig. 3, and vol. ix. p. 152, but not var. *præclara*).

\* δόρυ, a spear.

Genus *HARMERIA*, gen. nov.\*

Zoëcia ovate, thin, glassy, hyaline, with a scutiform or ovate space on the front, distinctly circumscribed by a raised line, within which the surface is punctate. Oral aperture semielliptic; lip straight in the younger stage, but afterwards overhung by a suboral collar-like process with more or less developed rostrum. No visible oëcia. No avicularia.

Type, *Harmeria scutulata* = *Lepralia scutulata*, Busk.

The mode of development in this genus is very remarkable. The zoëcia radiate from a centre, and the polyzoary is in the form of a round patch. It is only at the centre that the zoëcia attain their complete development and are fully exposed, so that their unpunctured bases are entirely visible; with succeeding growth additional zoëcia are continually interposed laterally, and each zoëcium is smaller in size than the one which precedes it, and at the same time overlaps its successor, so that at the circumference of the zoarium they are seen to be heaped up one upon another. The suboral rostrum differs much in size and sometimes assumes great development.

45. *Harmeria scutulata* (Busk).

1855. *Lepralia scutulata*, Busk, "Zoophytology," Quart. Journ. Mic. Sci. vol. iii. p. 255, pl. ii. figs. 1, 2.

1867. *Discopora scutulata*, Smitt, Öfvers. Kongl. Vet.-Akad. Förhand. p. 25, pl. xxvii. figs. 160, 161.

1895. *Cribrilina scutulata*, Nordgaard, Bergens Museums Aarbog, 1894-95, p. 20.

1900. *Cribrilina scutulata*, Bidentkap, Fauna Arctica, vol. i. p. 512.

On stones and shells of *Buccinum* between tide-marks at Vadsö, and Nordgaard records it from the Laminarian zone at Nordkyn. I also have it in my collection from 0-1 fathom, Smeerenberg Bay, Spitsbergen (*F. A. Smitt*). These last specimens are on *Laminaria*, and it would seem to be essentially a tide-mark or very shallow-water species. Busk's West Greenland types were "on fucus"; Smitt speaks of the specimens he has seen as being "in regione algarum haud frequentem," and as "*Laminariæ affixam*," but Bidentkap gives 16-20 metres.

\* \* From this point I do not propose to attempt any rearrangement of the rest of the Cheilostomata, and shall only refer to existing genera. I had already written the greater

\* Dedicated to my friend, Dr. S. F. Harmer, who is doing such admirable work in the study of the Polyzoa.



part of that which precedes as relates to new genera, and also contemplated the formation of some others relating to groups further on, when I received from Herr G. M. R. Levinsen his "Studies on Bryozoa." From that short paper I learnt that he was engaged on the rearrangement of the Polyzoa, and that he had made very extensive observations, and was thus in an excellent position to undertake the task. To him, therefore, I leave it as regards the rest of the Cheilostomata. But as I feel that I cannot use, as though they were my own, many associations of generic and specific names which have been employed, I shall signify my doubts as to the allocation of the species by printing the generic name within commas; at the same time I would have it to be understood that this only implies doubt, as in many cases I have not subjected the species to special critical examination.

#### Genus HIPPOTHOA, Lamouroux, 1821.

= *Celleporella*, Gray, 1848, = *Diazeuxia*, Jullien, 1888.

Type, *H. divaricata*, Lamouroux.

The genera of Gray and Jullien were founded on the same type, *Cellepora hyalina*, Linné.

In my paper, "A Month on the Trondhjem Fiord" (Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. 1894, p. 130), I wrote:—"Since Jullien declines even to place them [i. e. *Celleporella* (*Diazeuxia*) and *Hippothoa*] in the same family, it is better to wait for his further views rather than at once merge *Celleporella* in the earlier genus *Hippothoa*." Death has deprived us of Jullien's further opinion, and, for the reasons stated in my paper referred to, I now employ the genus *Hippothoa*. Levinsen has expressed the same opinion, though he "puts the cart before the horse" when he writes "the species of the genus *Hippothoa*, I think, must be merged in *Diazeuxia*" ("Studies on Bryozoa," Videns. Medd. Naturh. Fören. 1902, p. 23, separate copy); and Waters has (Journ. Linn. Soc., Zool. vol. xxviii. p. 70) placed *C. hyalina* in *Hippothoa*.

#### 46. *Hippothoa hyalina* (Linné).

On shells of *Buccinum*, *Neptunea*, &c. throughout the district\*.

\* In my Shetland Report of 1868 I recorded two Polyzoa of very small size and little character under the name *Celleporella lepralioides* and *Celleporella pygmæa*. The former is the same species which Hincks subsequently described under the name *Lagenipora socialis*, the latter may, I think, perhaps be placed in the genus *Phylactella*.



ESCHARINA, H. Milne-Edwards, 1836.

= *Herentia*, Gray, 1848 (first species *H. Hyndmanni*), = *Mastigophora*, Hincks, 1877 (type *M. Hyndmanni*).

Type, *E. vulgaris*, Moll.

Levinsen ("Studies of Bryozoa," p. 26) removes *Alderi* into *Mastigophora*, and I have now heard from him that he would also place in it *vulgaris*, which, with its keyhole-shaped oral opening and vibraculoid avicularia, which are situated unusually low down on the zoecium, comes very near *Hyndmanni*. When Hincks made his genera he ought to have employed *Herentia* and *Escharina*, instead of establishing *Mastigophora* and *Schizoporella*; but the taking *vulgaris* into the same genus with *Hyndmanni* will throw them all into the old genus *Escharina* (cf. Lamarck, Hist. ed. 2, p. 231, and Gray, List Brit. Radiata Brit. Mus. 1848, p. 123).

47. *Escharina Alderi*, Busk (= *Schizoporella Alderi*, Hincks).  
Sværholt (Nordgaard).

Genus SCHIZOPORELLA, Hincks, 1877.

Type, *Schizoporella unicornis*, Johnston.

*Schizoporella* embraces an extraordinary assemblage of species, as Levinsen has said the same form of oral opening occurs "within a number of different families, and it is impossible to put up sharply separated types of orifice. So, for instance, the forms of orifice regarded as characteristic for the genera *Lepralia* and *Schizoporella* are connected by a number of transitional forms not only with each other, but also with the orbicular and suborbicular orifice." The only species I have to record here will doubtless be removed by Levinsen from association with *Schizoporella unicornis*.

48. "*Schizoporella*" *sinuosa* (Busk).  
Sværholt (Nordgaard).

The following British *Schizoporellæ* have already been removed into other genera:—

*hyalina* into *Hippothoa*.

*Alderi* and *spinifera* by Levinsen into *Mastigophora*; and as I have now heard from him that he would also remove *vulgaris* with the above, the genus will become, as I have already pointed out, *Escharina*.

*venusta* into *Trypostega*, Levinsen, MS.

Genus *LEIESCHARA*, M. Sars.

[“Beskr. over nogle norske Polyzoer,” Videns.-Selskab. Förhand. 1862, p. 17 (separate copy).]

Type, *Leieschारा coarctata*, M. Sars.

I do not think that this genus, with its entirely different oral opening and its avicularia, can be united with the previously described *Myriozoon* (Donati), of which the type is the common Mediterranean species *M. truncatum*, Pallas.

49. *Leieschारा plana* (Dawson).

1860. *Lepralia plana*, J. W. Dawson, in Durban (W. S. M.) and Bell (R.), “Contributions to Canadian Natural History” (from Report Geological Survey for 1858), Montreal, p. 33.

1867. *Myriozoon crustaceum*, Smitt, “Kritisk Förteckning, &c.” p. 18, pl. xxv. figs. 88-91.

1878. *Leieschारा crustacea*, Smitt, “Recensio Bryozoarium ad insulas Novaja Semlya, &c.,” Öfvers. K. Vet.-Akad. Förhand. p. 20.

1886. *Schizoporella crustacea*, Lorenz, Bryozoën von Jan Mayen, p. 5, pl. vii. fig. 2.

1887. *Leieschारा crustacea*, Levinsen, Dijnphna-Togtets zool.-bot. Udbytte, p. 317.

1892. *Myriozoon planum*, Hincks, “Polyzoa of the St. Lawrence,” Ann. & Mag. Nat. Hist. ser. 6, vol. ix. p. 157.

1900. *Schizoporella crustacea*, Waters, “Bryozoa of Franz-Josef Land,” Linn. Soc. Journ., Zool. vol. xxviii. p. 64, pl. viii. figs. 11-13.

1901. *Myriozoon planum*, Whiteaves, “Cat. Marine Invert. of Eastern Canada” (Geol. Surv. Canada), Ottawa, p. 99.

It will be seen that Smitt, who had first placed this species and its allies in the genus *Myriozoon*, subsequently transferred them to *Leieschारा*. Dawson’s description of *Lepralia plana* was very inadequate; but I have seen specimens named by him, and there can be no doubt as to the species which he intended.

Varanger Fiord, 120-150 fathoms. I also have specimens from Parry’s Island, Spitsbergen, and Beeren Eiland Banks, 15-40 fathoms (*F. A. Smitt*); and Greenland, ‘Valorous,’ 1875.

*The Genus Eschारा.*

In 1724 John Ray described, in his ‘Synopsis methodica stirpium Britannicarum,’ p. 31, *Eschारा retiformis* from the south-east coast. He thought that it was vegetable, yet the few words of description make it clear that he meant the species described by Pallas. Ray, as pre-Linnean, cannot be the authority for the specific name.

Ellis (‘Nat. Hist. Corallines,’ 1745, p. 71, pl. xxx. figs. a, A, B, C) describes and figures our “*Eschारा foliacea*,” those

two words being merely the pre-Linnean commencement of his diagnosis; he gives also a figure *b*, "a piece of an Italian coral." Ellis refers to Ray as above.

Linné, in the tenth edition of the 'Systema Naturæ,' 1758, has an "*Eschara foliacea*," but this is what we now know as *Flustra foliacea*, and at p. 790 Ray and Ellis's species appears under the name *Millepora cellulosa*. In his 'Fauna Suecica,' edit. altera, 1761, he drops the genus *Eschara* altogether, and substitutes *Flustra* for certain species.

Pallas, in his admirable 'Elenchus Zoophytorum,' 1766, restores *Eschara*, blaming Linné for having substituted *Flustra*: "*Escharæ* nomen nuper ab Ill. Linnæo, sine nulla necessitate, cum *Flustræ* nova appellatione commutatum est (Faun. Suec. ed. ii.). Ego vero idem servare malui, cum antiquitate et communi autorum consensu ita innotuisse videatur, ut nulla confusio inde oriri possit, saltem non tanta, ut ad molestam et damnosam nominum arbitriam commutationem ideo confugiendum esse credam." In Pallas's work we have Ellis's species under the name *Eschara fascialis*, with two varieties, (*a*) the Mediterranean *fascialis*, (*b*) the broad-lobed British form *lamellosa*.

Linné, in Syst. Nat. ed. xii. 1768, gives us the name *Millepora fascialis*.

In Solander and Ellis, 1786, we find *Millepora foliacea*, and *Millepora fascialis*, Linn., as a synonym.

Lamarck ('Système des Animaux sans vertèbres,' 1801, p. 375) re-established *Eschara*, giving as his first species *Eschara foliacea*, with references to Ellis and Solander and Ellis.

Moll, in 'Eschara' (or 'Die Seerinde'), 1803, gives us on pl. i. excellent figures of what he names *Eschara fascialis* and its variety *lamellosa*.

From the time of publication of Lamarck's work of 1801 our largest British Cheilostomous Polyzoon has been known as the type of the genus *Eschara* (a genus dating back to 1724, when it was supposed to be of vegetable origin). But as used by Pallas in company with *Cellularia* these two genera included almost all the Cheilostomous Polyzoa known to him, and *Eschara* embraced such creeping forms as *Eschara (Electra) pilosa* and *Eschara (Microporella) ciliata*. The genus was restricted by Lamarck, and if, in his characters, he inserted one which was not in accordance with our present existing ideas, the characters should have been emended, not the genus destroyed; if genera were so treated none would exist after some years. Two forms described by Pallas of his *Eschara fascialis* I believe to be really varieties, and not

species. The Mediterranean form generally assumes a different mode of growth, that of narrow thongs instead of broad fronds, and the sides of the oral opening incline inwards in the middle (see Milne-Edwards, 'Recherches sur les *Eschares*,' pl. i. fig. 1 a; Waters, Ann. & Mag. Nat. Hist. ser. 5, vol. iii. pl. xv. fig. 8; Hincks, pl. lxxvii. fig. 4 = *Eschara bidentata*, M.-Edwards, l. c. pl. iii. fig. 2 a). I felt some doubt whether the Mediterranean and British forms should be regarded as one species, but that doubt was removed when an examination of their respective opercula proved them to be absolutely identical, showing that the difference in the oral opening was entirely superficial. It would appear therefore that our British form must be called

*Eschara fascialis*, Pallas.

Var. *foliacea*, Ell. & Sol. (= var. *lamellosa* of Pallas and Moll),

and such of the species of Hincks's *Lepralia* as may be regarded as congeneric with this species must be styled *Eschara*.

But had there been no genus *Eschara* to claim precedence, could the name *Lepralia* have been employed in the sense in which Hincks used it, for reasons which I have already given under *Lepralia*, Johnston, = *Membraniporella*, Hincks?

#### Genus DISCOPORA, Lamarck.

= *Umbonula*, Hincks.

Type, *Discopora verrucosa*, Lamarck.

Harmer has investigated the organization of this species (Quart. Journ. Micr. Sci. n. s. vol. xlv. p. 293, pl. xv. figs. 11, 12), and has placed *Mucronella pavonella*, Alder, in the same genus. He does not refer to the rosette-plates, so I may mention that there are only two in *pavonella*, but four which are multipored in *verrucosa*.

#### Genus PORELLA, Gray, 1848.

Type, *Porella compressa* (Sowerby).

50. *Porella concinna* (Busk).

Varanger Fiord, 120-150 fathoms.

51. *Porella aperta* (Boeck).

1861. *Lepralia aperta*, Boeck, Förh. Vid.-Selsk. Christiania, p. 50 (*vide* Smitt).



1868. *Porella levis*, Smitt, partim, "Kritisk Förteckning, &c." pt. iv. p. 21, and in description of plate "*Lepralia aperta*, Boeck," figs. 112-113.

1900. *Porella inflata*, Waters, "Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 83, pl. x. figs. 6, 7.

Waters appears to have overlooked the fact that this species had been described by Boeck, whose type Smitt had figured.

Lang Fiord. I have also in my collection specimens from Spitsbergen given me by Smitt under the name "*Porella levis*," and others collected by Principal Dawson in Gaspé Bay, Gulf of St. Lawrence.

## 52. *Porella struma* (Norman).

Sværholt (*Nordgaard*). I did not myself meet with this species in East Finmark. Specimens in my collection are from Shetland, Greenland, Gulf of St. Lawrence; "Cashes Ledge," N.E. America, as "*Eschara verrucosa (cervicornis)?*," from U.S. Nat. Mus.; and Bergen and Hardanger Fiords, Norway, where I found it to be not uncommon.

## 53. *Porella minuta* (Norman).

On stones between tide-marks at Vadsö in company with *Cribilina cryptoecium*, Norman, and *Harmeria scutulata*, Busk; also in Bög and Lang Fiords, 0-3 fathoms.

*Porella minuta* has very small zoecia, which are arranged in unusually regular lines radiating from the centre of the colony. Zoecia imperforate, more or less minutely granular, moderately raised; oral opening rounded above, straight at the sides, and straight lower lip (unless, as sometimes is the case, interrupted by the avicularium); the avicularium with rounded mandibles either within the oral opening, when a tooth-like process appears in front of it, or situated on the lip itself, and in the latter case more markedly there is a swelling on the zoecia below the lip indicative of the avicularian cell. Oecium semiglobose, imperforate. In old specimens there is some filling up of the spaces between the parallel lines of zoecia, which are often bridged over by bars of calcareous growth (see Hincks, pl. xxix. fig. 1).

The Vadsö specimens, which agree in every other respect, differ from those previously in my collection in having the surface of the zoecia ornamented with slightly raised lines converging from the sides; similar to the common condition of the zoecia in *Escharella immersa*.

54. *Porella proboscidea*, Hincks.

1888. *Porella proboscidea*, Hincks, "The Polyzoa of the St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. i. p. 223, pl. xiv. fig. 4.

1895. *Porella proboscidea*, Nordgaard, "Systemat. förteg. Norge Marine Polyzoa," Bergens Mus. Aarbog, 1894-95, no. 2, p. 25, pl. i. fig. 4.

Nordgaard records this species from Mehavn and Nordkyn.

55. *Porella lævis* (Fleming).

Mehavn (*Nordgaard*).

I take the opportunity of describing a Greenland *Porella*.

*Porella princeps*, sp. n. (Pl. IX. figs. 8-11.)

1892. *Monoporella spinulifera*, var. *præclara*, Hincks, "The Polyzoa of the St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. ix. p. 152, pl. viii. fig. 3.

Zoëcia of immense size, the largest known to me, measuring 1 millim. long and 0.6 to 0.7 broad, ovate or oblong, moderately convex, with deep separating sutures; shell-substance very massive and surrounding the oral opening like a collar; no oral spines; frontal surface punctate all over; origelles of slightly larger size are round the base. Oral opening well arched above, truncate below, but in old zoëcia sometimes subrotund. A large round avicularium within the lip and not rising quite to its level, so that it might be overlooked. The operculum (Pl. IX. fig. 10) has the form of three fifths of an oval, being rather longer than broad, abruptly truncate below, the angles slightly rounded off; from the angles proceeds a bar, for the attachment of the muscles, which bends a little inwards and then passes two thirds of the length of the operculum upwards, at some little distance from the margin. Colour rich rosy red.

A peculiarity of this species is the frequent presence of many aborted cells; in one case two zoëcia unite with one oral opening; but the usual abnormality consists in zoëcia having no room to grow among their large surrounding brethren, and consequently reduced in size, squeezed into all sorts of irregular shapes; many of these have an oral opening, many are quite "blind"; there may be as many as seven to ten blind zoëcia around and including the primary zoëcium (Pl. IX. fig. 9), as well as many others scattered throughout the zoarium. Oëcium buried below the surface (Pl. IX. fig. 11).

I have given Hincks's *Monoporella spinulifera*, var. *præclara*, as a synonym, under the assumption that he overlooked a deep-seated avicularium, the presence of which, however, appears to be indicated by the umbo-like swelling below the oral opening which he described and figured.

Taken by the 'Valorous,' 1875, off Holsteinborg, W. Greenland, in 57 fathoms.

Genus MONOPORELLA, Hincks, 1881.

Type, *Monoporella nodulifera*, Hincks.

*Monoporella spinulifera*, Hincks.

1889. *Mucronella spinulifera*, Hincks, "The Polyzoa of the St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 431, pl. xxi. fig. 3, and *Monoporella spinulifera*, vol. ix. p. 152 (but not var. *præclara*).

Hincks was quite right in making *Discopora cruenta*, Smitt (but not *Schizoporella cruenta* (Norman)), a synonym of this species, which I have in my collection from the Gulf of St. Lawrence (*Whiteaves*); Greenland, off Holsteinborg, 57 fathoms ('Valorous,' 1875); and Spitsbergen, lat. 76° 41' N., long. 10° E., in 100-120 fathoms, as "*Discopora cruenta*," from Smitt; and other specimens from Spitsbergen named "*Porina ciliata*, forma *dura*," from Smitt. I cannot understand how Mr. Waters ("Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. 1900, p. 73) can have reverted again to Smitt's mistaken name, and included *Monoporella spinulifera* under *Lepralia cruenta*; apart from all other differences, the front wall of the former is always entire and imperforated, the latter at all ages of growth has the front wall punctate, its oral opening is quite different, and it never has the little spine-point on the lower lip, which, though so insignificant in size, is a very marked characteristic of *spinulifera*.

### *Cryptic Oœcia.*

I have in this paper described an oœcium in *Cribrilina cryptoœcium* which becomes completely covered with overgrowth except the frontal arch, and Levinsen ("Studies of Bryozoa," p. 12) refers to other species which have what he terms "oœcia covered by kenozoœcia"; but in all these cases the oœcia are in the early stage on the surface of the zoarium and clearly seen. The character of the oœcia I am about to call attention to is entirely different. They belong to species of which no oœcia were previously known, and can only be found by partial decalcification of the frontal wall, when they

are discovered to be buried beneath it. The avicularium of *Porella princeps* cannot be seen from the front, and in order to have it revealed more clearly I decalcified the upper layers of this very strongly walled massive species. The result was that I not only laid bare the avicularium, but also an oecium of normal form over a zoecium (Pl. IX. fig. 11). This led me to treat in a similar manner two other species remarkable for the massiveness of their front wall, and of which no oecia were known; the result was the revelation of a very similar buried oecium in *Schizoporella cruenta* (Norman) (Pl. IX. fig. 13) and in *Monoporella spinulifera*, Hincks (Pl. IX. fig. 12). These oecia cannot be rare in these species, inasmuch as in each case the treatment of a single small fragment of the species sufficed to make known their existence.

“ESCHAROIDES,” “ESCHARELLA,” “MUCRONELLA.”

*Escharoides*, H. M.-Edwards (Lamarck, ed. 1836, pp. 218 & 259), embraced many species. Of these species Gray, 1848, made *Cellepora coccinea*, Abildgaard, the type (Cat. Brit. Radiata, p. 124). Authors are not agreed as to the species which Abildgaard described, some supposing it to be *ventricosa*, Hassall, or *immersa*, Fleming (= *Peachii*, Johnston), while others regard it, as English authors have done, as the *appensa* of Hassall. But there can be no doubt as to the species intended by both Milne-Edwards and Gray, since both give references to the *coccinea* of Fleming and of Johnston. Therefore in any division of the genus *Mucronella*, Hincks, which removes *coccinea* (= *appensa*) from it, that species should be placed in the genus *Escharoides*.

*Escharella*, Gray, 1848 (not *Escharella*, d'Orbigny, 1850, nor *Escharella*, Smitt), contained three species—*immersa*, Fleming (= *Peachii*, Johnston), *violacea*, Johnston, and *variolosa*, Johnston; the first and third of these point to this genus as another which had claim to have been used by Hincks when he instituted the genus *Mucronella*, which thus at the time of its creation was a synonym of two other genera which he included within it. *Mucronella* is a peculiarly appropriate name for the *immersa* section, but unfortunately it must yield to the earlier *Escharella*.

As long ago as 1879 Verrill saw the necessity of breaking up the genus *Mucronella* (Proc. U.S. Nat. Mus. 1879, p. 195), and proposed to use *Escharoides* for the *ventricosa* section and *Mucronella* for *appensa* (*coccinea*) and allies; but such a use of Hincks's genus *Mucronella* cannot be made, since he



specially placed all the species of the *ventricosa* section first, both in his original creation of the genus in 1879 and in his work; and we have seen that *Escharoides* can be used for the *appensa* section, but could not be used for the other.

Genus *ESCHARELLA*, Gray, 1848.

= *Mucronella*, Hincks, 1879.

Type, *Escharella immersa* (Fleming) (= *L. Peachii* Johnston).

Zoëcia convex or somewhat flattened; front wall strongly calcareous and granulated, generally imperforated on all the central portion; round the base a row of pores. Oral opening semicircular or nearly so, a mucro on the lower lip, and within it a simple or bifid denticle and a "well-developed oral bow" (*Levinson*). Operculum membranous. Oœcium semiglobose, imperforated. No avicularia. Rosette-plates very numerous (about 18-24) and carried round the distal margin, of the same character as those of the lateral margins.

The passages of communication between the walls of the zoëcium in this genus make a pretty appearance on the back. *Levinson's* figure of the back of *E. immersa* (*Zool. Dan.* pl. vi. fig. 3) is illustrative of all the species, though each has a character of its own. As regards the number, I shall count the number of the upper half of a side of the zoëcium to the centre of the distal margin, and the rosette-plates for a whole side will therefore be double that of the number given: *ventricosa*, 8-10; *immersa*, 5-7; *variolosa*, 10-12, the wall very thin; *abyssicola*, about 10.

Of species which should be excluded from *Escharella*—*appensa*, Hassall (= *coccinea* auct., but ? *Abildgaard*).—The back as well as the front of the zoëcium is utterly different from that of the true *Escharella*. It is like that of a *Callopora* or *Lepralia* (= *Membraniporella*), for there are one distal and two lateral pore-chambers exactly as in those genera. This species should, I think, be regarded as the type of *Milne-Edwards's* genus *Escharoides*. *Levinson* ("Studies of Bryozoa," p. 26) has created a genus *Peristomella* for it.

*pavonella*, Alder, is equally removed as the last from *ventricosa*; for the whole side of the zoëcium there are only two rosette-plates. Harmer would place it with *verrucosa* in the genus *Umbonula*, or, as I should say, *Discopora*.

*microstoma*, Norman.—I have not satisfied myself as to the position which this species should take; the semierect mouth, which is very small and round, and the oœcium tilted back off the zoëcium, seem to point to alliance with such a species as *sincera*.

56. *Escharella immersa* (Fleming).1828. *Berenicea immersa*, Fleming, Hist. Brit. Animals, p. 533.1847. *Lepralia Peachii*, Johnston, Hist. Brit. Zoophytes, edit. ii. p. 315, pl. lv. figs. 5, 6.

To remove any doubt as to this synonymy, I may state that I have examined Johnston's specimens of *Lepralia immersa* in the British Museum, and they are undoubtedly the same as his *L. Peachii*.

Taken at Nordkyn (*Nordgaard*).

57. *Escharella abyssicola* (Norman).

Sværholt (*Nordgaard*).

58. "*Mucronella*" *sincera* (Smitt).1867. *Discopora sincera*, Smitt, "Kritisk Förteckning, &c." p. 28, pl. xxvii. figs. 178-180.1876. *Discopora sincera*, Norman, 'Valorous' Report, Proc. Roy. Soc. vol. xxv. p. 208.1877. *Lepralia sincera*, Hincks, "Polyzoa Iceland and Labrador," Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 102, pl. xi. fig. 2.1880. *Hemeschara sincera*, Busk, "Polyzoa North Polar Exped.," Journ. Linn. Soc., Zool. vol. xv. p. 237.1880. *Mucronella simplex*, Hincks, "Hydrozoa and Polyzoa of Barents Sea," Ann. & Mag. Nat. Hist. ser. 5, vol. vi. p. 280, pl. xv. fig. 7.1900. *Mucronella sincera*, Nordgaard, Norwegian N. Atlan. Exped. xxviii. Polyzoa, p. 14, pl. i. figs. 13-15.

Bög Fiord, East Finmark, in 120 fathoms (*A. M. N.*); Sværholt (*Nordgaard*). Other specimens in my collection are from Spitsbergen (*Smitt*); off Hare Island, Waigat Strait, Greenland, 175 fathoms ('Valorous,' 1875); also Greenland (Copenhagen Museum), and Proven, Greenland (*Smitt*); and the form *Mucronella prælucida*, Hincks, Gulf of St. Lawrence (*Whiteaves*).

The oral opening is subject to considerable variation; the lower lip is often more or less produced, commonly evenly (see *Nordgaard's* figure 15), more rarely acutely (as *Nordgaard*, figs. 13, 14), and the last condition seems to be the *Mucronella simplex*, Hincks, and hence it has been placed by himself and *Nordgaard* in the genus *Mucronella*; but with this genus it has no connexion, for the oral point is a mere projection of the margin, and, as Hincks himself wrote, "the oral denticle is wanting." The form of the oral opening is also subject to considerable variation. In zoëcia without oëcia the outline is circular or subcircular, but in other cases (Spitsbergen examples) it is nearly of the form assigned by Hincks to his genus *Lepralia*. Oral spines are unknown.

Avicularia I have seen sparingly developed, but only on Spitsbergen specimens and on one side of the zoëcium, as figured by Smitt. Nordgaard, however, illustrates a zoëcium with two avicularia, which were developed on a specimen from a "place unknown."

Nordgaard has referred the *Mucronella præluca* of Hincks\* with a ? to this species. With respect to the Queen Charlotte Islands type specimens I think that there may be some doubt, but I am very much inclined to refer the St. Lawrence form to *M. sincera*. I have a specimen from that locality the zoëcia of which exactly correspond with the left-hand zoëcium of Hincks's illustration; but the oral lip processes are none of them truncate as drawn on the other three oëcia. I consider my specimen to be *M. præluca* (of St. Lawrence), a variety of *M. sincera* in which the zoëcia are shorter than usual.

59. "*Mucronella*" *labiata* (Boeck).

1867. *Discopora coccinea*, forma *labiata*, Boeck MS., Smitt, "Kritisk Förteckning, &c." p. 27, pl. xxvii. fig. 176.

1878. *Discopora labiata*, Smitt, Öfvers. Kongl. Vet.-Akad. Förhand. p. 23.

1880. *Phylactella* (?) *grandis*, Hincks, "Hydrozoa and Polyzoa Barents Sea," Ann. & Mag. Nat. Hist. ser. 5, vol. vi. p. 280, pl. xv. figs. 4, 5.

1887. *Mucronella labiata*, Levinsen, Dijnphna-Togtets zool.-botan. Udbytte, p. 323.

1900. *Phylactella* (?) *labiata*, Waters, "Bryozoa from Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 90, pl. xii. figs. 3, 4 (illustrations of the larva).

Varanger Fiord, in 120-150 fathoms, on shell of *Astarte*, and Nordgaard has kindly sent me a specimen from Sværholt. This last specimen is developed on *Hornera lichenoides*, a habitat which the species seems especially to affect, as fine examples were dredged upon it in 175 fathoms off Hare Island, Disco, Greenland, by the 'Valorous' in 1875.

It would seem that Smitt at first included more than one form under the term "forma *labiata*," since a specimen received from him just after he had finished his work is undoubtedly a variety of *Escharella ventricosa* with produced lip; but I think that there can be no doubt that his figure 176 represents the species which was subsequently named by Hincks *Phylactella* (?) *grandis*.

It would be quite possible that *Escharella abyssicola* might be mistaken for this species. There is a very general resem-

\* "Polyzoa Queen Charlotte Islands," Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 26, pl. iv. fig. 1; and "Polyzoa St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. i. p. 225, pl. xv. fig. 3.

blance, especially when the oral lip is more than usually produced, as in the specimen figured by Hincks (pl. xxxviii. fig. 1); but that species may be at once distinguished by the presence of a bifid denticle within the mouth; this denticle is deeply seated and is not shown in the figures given by Hincks, though his description is entirely accurate.

#### Genus PALMICELLARIA, Alder.

##### 60. *Palmicellaria Skenei* (Ellis & Solander).

The variety *bicornis* (Busk, Crag Polyz. pl. viii. figs. 6, 7) has been recorded by Nordgaard from Sværholt.

#### Genus SMITTINA, nov. nom.

= *Smittia*, Hincks, 1879 (partim), nec *Smittia*, Holmgren, 1874 (Diptera),  
= *Escharella*, Smith (partim, nec *Escharella*, Gray).

Type, *Smittina Landsborovii*, Johnston.

Some of the following species, as well as others which have been described, will not be allowed to remain, in my opinion, in this genus, which no doubt Levinsen will revise; such species are those in which there is an absence of the "lyrula" or tooth-like process behind the avicularium (which is a product of the primary orifice), and there is an absence of the "origelles" at the base of the zoecium, and other material differences.

##### 61. *Smittina Jeffreysi*, Norman.

1876. *Lepralia Jeffreysi*, Norman, "Biology of 'Valorous' Cruise," Proc. Roy. Soc. vol. xxv. p. 208.

1877. *Lepralia trispinosa*, var., Hincks, "Polyzoa of Iceland and Labrador," Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 160, pl. xi. fig. 1.

1887. *Escharella trispinosa*, var. *arborea*, Levinsen, *Dijmphna-Togtets zool.-bot. Udbytte*, p. 320, pl. xxvii. figs. 7, 8.

1897. *Smittia trispinosa*, var. *arborea*, Bidentkap, "Bryozoen von Ost-Spitsbergen," Zool. Jahrbücher, vol. x. p. 619.

1900. *Smittia trispinosa*, var. *arborea*, Nordgaard, Norweg. N. Atl. Exped., Polyzoa, p. 13, pl. i. fig. 9.

1900. *Smittia trispinosa*, var. *lamellosa*, Smitt, Waters, "Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 88, pl. xii. figs. 19-21.

This form or species has been recorded from the Porsanger Fiord by Nordgaard.

It is a common form in the Arctic seas, and very generally rises in free hollow cups or tubes, often branching. Among other characters, this northern form is remarkable for the abundant distribution of oval avicularia on the zoecia, as



well as one of larger size and acute mandible ; but the most important difference is the form of the oral opening, which in this northern form, whether it be tubular or encrusting, is wider below than above and has a straight underlip.

In my cabinet are specimens from off Disco, Greenland, 100 fathoms ('Valorous,' 1875); Gulf of St. Lawrence (*Whiteaves*); Cashes Ledge, N.E. America (*Verrill*, as "*Escharella Jacotini*").

I am indebted to Smitt for a specimen of his var. *lamellosa* from Spitsbergen, which certainly has not the characters of the foregoing form, nor does d'Orbigny's figure (Pal. Franç. Crét. pl. dcccxii. fig. 1) of his *Semieschara lamellosa*, to which Smitt refers, bear any resemblance to it ; it is wholly without avicularia.

## 62. *Smittina arctica*, Norman.

1869. *Escharella porifera*, forma *majuscula*, Smitt, "Krit. Förteck. &c." pt. iv. p. 9, pl. xxiv. figs. 36-38, and forma *minuscula*, figs. 33-35.

1888. *Smittia Landsborovii*, form *porifera*, Hincks, "Polyzoa St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. i. p. 225, pl. xiv. fig. 2.

1894. *Smittia arctica*, Norman, "A Month on the Trondhjem Fiord," Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. p. 128.

1895. *Smittia arctica*, Nordgaard, "System. förtegn. Norge Marine Polyzoa," Bergens Mus. Aarbog, no. 2, p. 27, pl. i. fig. 2.

1900. *Smittia Landsborovii*, var., Waters, "Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 90, pl. xii. fig. 7.

This is a very pretty form, the front wall regularly punctate all over ; the avicularium on or just below the lower lip of the oral opening with round mandible and a very slender lyrula behind it, which, however, can seldom be seen except on young specimens ; sides and upper lip of oral opening raised ; the oecium, which is imperforated, generally but not always falls back from the raised upper margin of the oral opening.

I do not understand the transverse and circular lines which Nordgaard represents on the oecium ; Waters's figure is characteristic, but the upper lip and the attachment of oecium are rather more marked in their special character than usual.

On an annelid tube in Bög Fiord in 100-120 fathoms.

## 63. "*Smittia*" *porifera* (Smitt).

1867. *Escharella porifera* (typica), Smitt, "Kritisk Förteckning, &c." p. 9, pl. xxiv. figs. 30-32.

1877. *Lepralia porifera*, Hincks, "Polyzoa of Iceland and Labrador," Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 102, pl. x. figs. 1, 2.

1895. *Smittia porifera*, Nordgaard, "System. förtegn. i Norge Marine Polyzoa," Bergens Mus. Aarbog, 1894-95, p. 26, pl. ii. fig. 1.

1900. *Lepralia porifera*, Waters, "Bryozoa Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 75, pl. viii. figs. 14, 15.

Waters has figured the operculum, which I have not myself examined.

Mehavn, East Finmark (*Nordgaard*).

Specimens in my collection are from Spitsbergen (*Smitt*), Gulf of St. Lawrence (*Principal Dawson*), and West Greenland ('Valorous,' 1875).

Smitt, in his work on the Floridan Bryozoa, separated his formæ *majuscula* and *minuscula* from *porifera*, and regarded his typical *porifera* as more nearly related to *palmata* and the other forms to *Landsborovii*.

64. "*Smittia*" *lineata*, Nordgaard. (Pl. IX. figs. 14, 15.)

1895. *Smittia lineata*, Nordgaard, "System. förtegn. i Norge Marine Polyzoa," Bergens Mus. Aarbog, 1894-95, no. 2, p. 27, pl. ii. fig. 2.

This recently described species has been known to me for years, and has been regarded as an undescribed form.

The types of Nordgaard were taken by him off Nordkyn, and I am indebted to him for a specimen which enables me to be certain of its identification; and I also found the species in another East Finmark locality—namely, encrusting *Escharopsis rosacea* dredged off Vadsö.

Other specimens in my collection are one received from Smitt taken at Spitsbergen, and named *Escharella auriculata*; others from the Gulf of St. Lawrence (*Whiteaves*), and off Holsteinborg, Greenland, in 57 fathoms ('Valorous,' 1875).

This, in my opinion, cannot remain in the present genus, and is more nearly related to *auriculata*, as Smitt considered it. I have figured the operculum of *auriculata* (Pl. IX. fig. 16) for comparison with that of *lineata* (fig. 15).

65. "*Lepralia*" *reticulato-punctata*, Hincks.

1867. *Escharella porifera*, forma *edentata*, Smitt, "Krit. Förteck., &c." pt. iv. p. 9, pl. xxiv. fig. 39.

1877. *Lepralia reticulato-punctata*, Hincks, "Polyzoa Iceland and Labrador," Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 103, pl. x. figs. 3, 4.

1887. *Escharella reticulato-punctata*, Levinsen, Dijnphna-Togtets zool.-bot. Udbytte, p. 318, pl. xxvii. fig. 4 (the operculum).

I dredged this species in 100-120 fathoms in Bög Fiord, and Nordgaard records it from Sværholt. I have it also from Spitsbergen (*Smitt*), Jan Mayen (Austro-Hungarian

Exped.), Gaspé, Gulf of St. Lawrence (*Principal Dawson*), and West Greenland ('*Valorous*,' 1875).

It is probable that Smitt's figure of "*forma cancellata*" (figs. 40, 41) may also belong to this species, but I have not seen any specimens identical, that is, having the projecting point on the under lip. Kirchenpauer, in 1874, named this last form *Hemeschara* (?) *contorta* ('*Die zweite deutsche Nordpolarfahrt*,' vol. ii. p. 422).

Levinsen, who figures the operculum, says rightly of the avicularia: "*avicularia in plurimis desunt; ubi adsunt, paulo sub peristomia varie deposita.*"

I may mention here another species which has been often described and would appear to be allied to some of the preceding forms.

"*Lepralia*" *Smitti*, Kirchenpauer.

1867. *Escharella Legentilii*, forma *prototypa*, Smitt, "*Kritisk Förteck.*, &c." p. 10, pl. xxiv. figs. 47-49.

1874. *Lepralia Smitti*, Kirchenpauer, *Die zweite deutsche Nordpolarfahrt*, vol. ii. p. 420.

1887. *Escharella reticulata*, Levinsen, *Dijmphna-Togtets zool.-bot. Udbytte*, p. 319, pl. xxvii. figs. 5 & 6.

1892. *Schizoporella cincta*, var., Hincks, "*Polyzoa St. Lawrence*," *Ann. & Mag. Nat. Hist.* ser. 6, vol. ix. p. 154, pl. viii. fig. 2.

1897. *Smittia reticulata*, Bidentkap, "*Bryozoen von Ost-Spitsbergen*," *Zool. Jahrbücher*, vol. x. p. 622, pl. xxv. fig. 3.

1900. *Schizoporella Harmsworthii*, Waters, "*Bryozoa Franz-Josef Land*," *Journ. Linn. Soc., Zool.* vol. xxviii. p. 65, pl. ix. figs. 10-12.

The known localities of this species are Spitsbergen (*Smitt*), East Greenland (*Kirchenpauer*), Gulf of St. Lawrence (*Hincks*), Kara Sea (*Levinsen*), and Franz-Josef Land (*Waters*) \*.

Genus *ESCHAROPSIS*, Verrill †.

= *Escharoides*, Smitt, Hincks, &c. (nec H. Milne-Edwards).

Type, *Escharopsis lobata*, Lamouroux, = *E. Sarsii*, Smitt.

66. *Escharopsis rosacea* (Busk).

Not uncommon near Vadsö and in the middle of the Varanger Fiord down to 100-120 fathoms; also recorded by Nordgaard from Sværholt in 30-40 fathoms.

Other localities from which examples are in my cabinet

\* Since this paper was sent to the printer, *Lepralia Smitti* has received yet another name, viz. *Smittia Levinseni*, Nordgaard, '*Die Bryozoen des westlichen Norwegens*,' 1903, p. 92.

† Verrill, *Proc. U.S. Nat. Mus.* 1879, p. 196.

are Greenland, off Holsteinborg, 57 fathoms ('Valorous,' 1875); Brandewyne Bay, Spitsbergen (*Smitt*); Orphan Bank, Gulf of St. Lawrence (*Smitt*); Loch Fyne, Scotland (*A. M. N.*).

Genus *PSEUDOFLUSTRA*, Bidentkap\*.

Type, *Pseudoflustra solida*, Stimpson.

67. *Pseudoflustra solida* (Stimpson).

1853. *Flustra solida*, Stimpson, Invert. of Grand Manan, p. 19, pl. i. figs. 12 a, b.  
 1862. *Eschara palmata*, M. Sars, "Beskr. over nogle norske Polyzoer," Vidensk. Selsk. Förhand. 1862, p. 8 (separate copy).  
 1867. *Escharella palmata*, Smitt, "Krit. Förteck., &c." Öfvers. K. Vet.-Akad. Förhand. p. 10 (separate copy), pl. xxiv. figs. 42-46.  
 1879. *Flustrimorpha solida*, Verrill, Proc. U.S. Nat. Mus. p. 191.  
 1880. *Flustra solida*, Hincks, "Hydroida and Polyzoa from Barents Sea," Ann. & Mag. Nat. Hist. ser. 5, vol. vi. p. 282, pl. xv. figs. 2, 3.  
 1882. *Eschara solida*, Vigelius, "Cat. Polyzoa of 'Willem Barents' in 1878 and 1879," Niederl. Archiv f. Zoologie, p. 15, figs. 2 & 3 a, b.  
 1887. *Escharella palmata*, Levensen, Dijnphna-Togtets zool.-bot. Udbytte, p. 318, pl. xxvii. fig. 3.  
 1892. *Flustra solida*, Hincks, "Polyzoa of the St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. ix. p. 149, pl. viii. figs. 1 & 1 a-c.  
 1897. *Pseudoflustra solida*, Bidentkap, "Bryozoen von Ost-Spitsbergen," Zool. Jahrbücher, vol. x. p. 618.  
 1900. *Smittia palmata*, Nordgaard, Norweg. N. Atl. Exped., Polyzoa, p. 12.  
 1900. *Pseudoflustra palmata*, Waters, "Bryozoa from Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 71, pl. viii. figs. 7-8 (operculum and avicularium).

I have given this list of references, only omitting those which relate solely to the record of a locality, to show how this unfortunate species has been thrown from genus to genus. Let us hope that it will now find a resting-place in a genus of which it is made, and, I think, rightly made, the type. In the latest paper in the list above given Mr. Waters discards Stimpson's specific name *solida*, and uses the later *palmata*. He does this upon the ground that it is not clear that Stimpson's description refers to this species, and then he proceeds not only to give a reference to Stimpson without any mark of interrogation, but also inserts Stimpson's locality as one of the habitats of the species. That the European Arctic species belongs to the same genus, and is apparently only a slight variation of the species described by Stimpson, is, I think, quite clear from the fact that the description and figure in the 'Invertebrata of Grand Manan,'

\* Bidentkap, "Bryozoen von Ost-Spitsbergen," Zoolog. Jahrbücher, vol. x. 1897, p. 618.



though not minutely accurate, can apply to no other genus ; and, secondly, because Stimpson's form is well known in the district where he found it and also in the Gulf of St. Lawrence. *Pseudoflustra* is perhaps hardly a happy name to have given to the genus, but becomes expressive when the specific name *solida* is added to it.

The following differences are seen in the specimens in my collection :—

*a.* Cashes Ledge, N.E. America, 70 fathoms (*Prof. Verrill*).—The form described by Hincks in his St. Lawrence paper, p. 150. The growth is in narrow strips, which at the same time are somewhat thicker and more solid-looking than the other varieties. The avicularium is nearly round (see Hincks, fig. 1) ; a slight sinus is more or less evident on the lower margin of the oral opening, but this sinus is not evident on oœcium-bearing zoœcia. Length of a frond 25 millim., greatest breadth 4 millim.

*b.* "*Escharella palmata*, Sars, Spitsbergen," from F. A. Smitt.—Zoœcia narrow and greatly elongated ; avicularium linguiform (as Smitt, fig. 43).

*c.* Varanger Fiord, 100–150 fathoms.—Frond very thin and broad, 18 millim. long, 13 millim. broad. Zoœcia of much larger size than from the other localities, not much produced ; avicularia linguiform (as Smitt, fig. 44).

It was also taken by the Norwegian North-Atlantic Expedition off Vardö (Stat. 262).

#### Genus RHAMPHOSTOMELLA, Lorenz.

Type, *Rhamphostomella scabra* (Fabricius), Smitt.

#### 68. *Rhamphostomella costata*, Lorenz.

1867. *Cellepora scabra*, Smitt (*partim*), "Krit. Förteckning, &c." p. 30, pl. xxviii. figs. 186–188.

1886. *Rhamphostomella costata*, Lorenz, Bryozoen von Jan Mayen, p. 12, pl. vii. fig. 11.

1892. *Rhamphostomella costata*, Hincks, "Polyzoa St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 426, pl. xxi. figs. 6–8.

Varanger Fiord, in 120–150 fathoms, and Nordgaard records it from Mehavn, and it was dredged by the Norwegian North Atlantic Expedition off Porsanger Fiord (Stat. 260).

#### 69. *Rhamphostomella plicata*, Smitt.

1867. *Cellepora scabra*, forma *plicata*, Smitt, *l. c.* p. 30, pl. xxviii. figs. 189–191, 195.

1877. *Cellepora plicata*, Hincks, "Polyzoa Iceland and Labrador," Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 106, pl. xi. figs. 3, 4.  
 1886. *Rhaphostomella plicata*, Lorenz, l. c. p. 12.

I dredged this form in 120–150 fathoms in the Varanger Fiord; also found at Nordkyn (*Nordgaard*).

GENUS *CELLEPORA*, Fabricius.

Type, *Cellepora pumicosa* (Pallas), Linné.

70. *Cellepora pumicosa*, Pallas.

Varanger and Lang Fiords and Vardö. Nordgaard records it from Sværholt.

71. *Cellepora ramulosa*, Linné.

Mehavn (*Nordgaard*).

GENUS *RETEPORA*, Lamarck.

Type, *Retepora reticulata* (Imperato), Lamarck.

*Retepora Beaniana*, King.

Bög Fiord, in 120 fathoms; also Sværholt (*Nordgaard*) and Vadsö (*Danielssen*).

72. *Retepora cellulosa*, Linné.

1867. *Retepora cellulosa*, Smitt, "Krit. Förteck., &c." p. 35, pl. xxviii. figs. 222–225.  
 1895. *Retepora cellulosa*, Waters, "Mediterranean and New Zealand Reteporæ," Journ. Linn. Soc., Zool. vol. xxv. p. 259, pl. vi. figs. 17 & 19, pl. vii. fig. 12.

In Bög Fiord, 120 fathoms, and also in Lang Fiord, in 20–30 fathoms (*A. M. N.*); Mehavn and Nordkyn (*Nordgaard*).

73. *Retepora Wallichiana*, Busk.

1867. *Retepora cellulosa*, forma *notopachys*, var. *elongata*, Smitt, "Kritisk. Förteckning, &c." p. 36, pl. xxviii. figs. 226–232.  
 1877. *Retepora Wallichiana*, Busk MS., Hincks, "Polyzoa from Iceland and Labrador," Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 107, pl. xi. figs. 9–13.  
 1878. *Discopora elongata*, Smitt, "Recensio Bryoz. Nov. Semlya," Œfvers. K. Vet.-Akad. Förhand. p. 25 (separate copy).  
 1887. *Retepora elongata*, Levinsen, Dijnphna-Togtets zool.-bot. Udbytte, p. 323, pl. xxvii. fig. 12.

Lang Fiord.

In examining this species the descriptions of Hincks and of Levinsen should be consulted in addition to Smitt's work.

EXPLANATION OF THE PLATES.

N.B.—The description of figures 1 and 2 in this Plate, *Callopora nigrans*, will be found in the preceding part of these papers, vol. xi. p. 593.

PLATE VIII.

- Fig. 1. *Callopora nigrans*, Hincks. *a*, young zoecium; *b*, with avicularia; *c*, an unusual form of oecium in a part where growth is very rapid and there are no avicularia. These zoecia, and also those of fig. 2, not developed side by side, but brought here together for illustration. Fig. *b* resembles state illustrated by Waters from Franz-Josef Land.
- Fig. 2. *Callopora nigrans*, Hincks. *a*, early stage of development of oecium; *b*, the usual form of oecium; *c*, a form of which I have only seen two or three examples (it is this form which is figured by Hincks).
- Fig. 3. *Larnacicus corniger*, Busk, with oecium, and the chambers in the situation usually occupied by an oecium.
- Fig. 4. *Antropora granulifera*, Hincks. View of the back of a zoecium: *a*, openings resulting from the avicularia; below these are seen the pair of lucid bays, and below again the lucid spots.
- Fig. 5. *Ammatophora nodulosa*, Hincks. This and the following two figures have been taken from specimens in which the epitheca has been removed in order to show the structure. The form of the oecium represented in fig. 5 is seldom seen.
- Figs. 6 & 7. *Ammatophora nodulosa*, Hincks. The more usual forms of the oecium: fig. 6 the younger, fig. 7 the mature condition.
- Fig. 8. *Lepralia nitida*, Fabricius. Three bars of the zoecium, to show their structure.
- Fig. 9. *Lepralia melolontha*, Landsborough. Three front bars, to show the structure.
- Fig. 10. *Cribrilina annulata*, Fabricius. Three bars of the zoecium of a very simple form of this species.
- Fig. 11. *Cribrilina annulata*, var. *spitsbergensis*, Norman. Anterior portion of a zoecium.
- Fig. 12. *Gephyrotes nitido-punctata*, Smitt. The anterior portion of a zoecium, to show the structure of the bridge and oral opening.
- Fig. 13. *Gephyrotes nitido-punctata*, Smitt. Middle bars of the zoecium.

PLATE IX.

- Fig. 1. *Cribrilina cryptoecium*, Norman. Zoecium with oecium in earliest stage of development as seen at the edge of a zoarium.
- Fig. 2. The same. An older zoecium, with the oecium except the front arch concealed beneath overgrowth, and a transverse rib developed over it.
- Fig. 3. *Cribrilina innominata*, Couch. Three bars of zoecium: *a*, *b*, lateral papillæ; *c*, the opening outside the arch of the bars and into the body of the Polyzoön, which a papilla has occupied.
- Fig. 4. *Cribrilina Gattyæ*, Busk. Anterior portion of a zoecium of the ordinary form.
- Fig. 5. *Cribrilina Gattyæ*. Variety on shell from Guernsey, with interesting duplicated lateral lacunes.
- Fig. 6. *Cribrilina Balzaci* (Audouin), Waters, from Madeira.
- Fig. 7. *Cribrilina figularis*, Johnston, showing the very large lumen-pore on the base of the bars, the small lateral lacunes, and narrow chinks (? openings for papillæ) between the loops of the bars.

Fig. 8. *Porella princeps*, Norman.

Fig. 9. The same, to show the number of blind zoecia ("kenozoecia," Levinsen) and irregularly shaped zoecia around the ancestrula.

Fig. 10. The same, operculum.

Fig. 11. The same, in which the thick outer calcareous wall has been removed by acid, and a previously entirely concealed oecium and the oral avicularium have been exposed to view.

Fig. 12. *Monoporella spinulifera*, Hincks. A zoecium which has, like the last, been partially decalcified, and an oecium has been brought to view.

Fig. 13. *Schizoporella cruenta*, Norman. A zoecium which has been similarly treated, as the two previous species, with nitric acid, and an oecium of which the existence was previously unknown has been brought to light.

Fig. 14. *Smittia lineata*, Nordgaard.

Fig. 15. The same. Operculum and outline of margin more magnified.

Fig. 16. *Schizoporella auriculata*, Hassall. Operculum, for comparison with the preceding.

VI.—*Notes from the Gatty Marine Laboratory, St. Andrews.*  
No. XXV. By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c.

[Plates X.-XIII.]

1. On the *Eunicidæ* dredged by H.M.S. 'Porcupine' in 1869 and 1870.
2. On Canadian *Eunicidæ* dredged by Dr. Whiteaves, of the Canadian Geological Survey, in 1871-1873.
3. On Norwegian *Eunicidæ* collected by Canon Norman, D.C.L., F.R.S.

1. *On the Eunicidæ dredged by H.M.S. 'Porcupine' in 1869 and 1870.*

A species of *Diopatra* was procured in the Expedition of 1870, at Station 50, off the Algerine coast, near Cape Tencz, in 7-51 fathoms, which most closely approaches *Diopatra neapolitana*, Delle Chiaje.

It consisted only of a fragment of a small example, about half an inch long, and comprising the head and about thirty of the anterior segments. The head is characterized by the great size of the tentacles, their enlarged ringed ceratophores, and the presence of two short, spindle-shaped, frontal tentacles. The palpi have a tuberculated anterior border. The eyes have disappeared, whereas in the Neapolitan examples they are present. The body is rounded in front, the first segment—which is no wider than the succeeding—being devoid of feet. From its anterior border project the



two slender subulate tentacular cirri, which are nearer each other than the corresponding organs in *Eunice*. In contrast with the Neapolitan examples, the specimen procured by the 'Porcupine' is much smaller, its tentacles rather longer, the branchial spirals have shorter pinnæ, and its coloration less deep.

The dental apparatus in examples of *Diopatra neapolitana* from Naples and that from the 'Porcupine' is very closely allied. In both the colour is pale chocolate, with a dark brown bar separating the maxillæ from the posterior appendages, a dark brown spot at the posterior end of each great dental plate, and a narrow, slightly fusiform, brown belt bounding the curved anterior plates and appearing on the ventral surface. The curvature of the maxillæ is the same in both, and the tips, which leave the horizontal plane, are more deeply tinted than the rest. The posterior appendages form together a spatula-shaped structure with a notch between them posteriorly, and a constriction where they join the maxillary suture. In proportion to its size the spathulate enlargements of these processes are shorter and broader in the Neapolitan form, and a distinct flange a short distance from the inner edge just in front of the articulation with the posterior appendages is present on each maxilla. The small size of the example from the 'Porcupine' may, however, account for the indistinctness of such a structure. The left great dental plate in the Neapolitan has eight teeth; in the 'Porcupine' form there are ten. The azygos plate in the former has six teeth—a portion posteriorly having a smooth edge; in the latter seven or eight. The right great dental plate in the former has seven teeth, and, like the plate of the opposite side, an additional slight elevation; in the latter this plate has seven teeth, an adjoining elevation, and a longer bare margin posteriorly. The left anterior curved plate has five teeth in the Neapolitan; in the other apparently the same number. The former has a horny plate externally, with a single tooth and a small plate behind; the latter also shows a horny point on a small plate, but the specimen is incomplete. In the former the right anterior curved plate has eight teeth, and the outer plate a single tooth; in the latter the right anterior curved plate has at least seven teeth, and an outer plate with a horny tooth.

The dentary edge of the mandibles in the Neapolitan form shows a larger foliate outer tooth, a middle stout conical tooth, and an inner rounded ridge. A dark brown touch

marks the end of the shafts externally, and a small black speck is near the inner margin. The shafts are brown and of moderate length. Unfortunately the mandibles in the 'Porcupine' form were broken, but sufficient remained to show that the dentary edge, though slightly sinuous internally, was more or less entire. The small size of the example probably accounts for this variation.

Other examples from Naples show variations in the number of teeth on the several plates, so that the divergencies indicated are not of essential importance.

The first four or five feet are larger than the succeeding, from the elongation of the proximal region, and this is especially the case with the first three, which are directed forward and outward, and to a less extent with the fourth. All these appear to be developed for special functions, and they are very vascular, a network of anastomosing vessels occurring from base to tip. The first is the longest and largest, bearing dorsally a cirrus of considerable proportional size, and which arises towards the tip from a basal enlargement. A group of slender spines, as in *Eunice*, passes through the basal segment to the cirrus itself. Beneath is a bluntly conical setigerous region with a long subulate papilla at its extremity. The ventral cirrus is somewhat fusiform in outline—constricted at the base, then enlarged, and finally tapering to the tip. The setigerous region is supported by two pale spines, and has superiorly rather stout dorsal bristles, none of which project beyond the tissues, but they appear to be simple with a short tapering region at the tip and winged. The ventral bristles (passing below the spines) have a feebly marked articulation and a long tapering terminal piece, which has a bifid claw guarded by wings.

The 2nd, 3rd, and 4th feet are similar to the 1st, but the bristles, especially the ventral, are stronger (Pl. X. fig. 1). The 5th foot has a branchial process of full-size, arising from the site of the dorsal cirrus, but so large is it that the cirrus appears to be a mere process of its outer wall. Every succeeding segment in the preparation has a stem, the slender spines of the region traversing their origin and going beyond into the cirrus for three-fourths of its length, in the posterior feet of the fragment.

The feet of the Neapolitan and 'Porcupine' forms agree in general contour, and in being double—that is, having a dorsal and a ventral division, as indicated by a group of spines which penetrate the base of the dorsal cirrus, and in having bifid bristles. In the Neapolitan form the 1st foot

has about six strong spines with tapered tips supporting the setigerous lobe, which bears a series of translucent yellowish bristles which have a slight curvature at the tip and diminish a little towards the pseudo-articulation. The tip varies in length, and ends in a bifid hook with a pair of pointed wings, which spring from the sides where the tip begins to be differentiated. These bristles are also found on the 2nd and 3rd feet; but on the 4th, where the first branchial process is, they are replaced by simple bristles with winged tips. The secondary spur below the terminal hook is often very slender and appears to be readily abraded, since many show no trace of it.

In the example from the 'Porcupine' the bristles of the first four feet (that is, one more than in the Neapolitan) have a similar outline, but the bifid tip has its secondary process more distinct. In this, as in the Neapolitan form, the developing bristles show the respective differentiations as clearly as those fully formed, the tip being the first part to appear. The spines supporting the setigerous region are fewer, viz. about four. The simple winged bristles which supplant the foregoing special bristles appear in the 5th foot, which bears the first branchial stem.

At the 10th foot of the Neapolitan form the bristles are stout, have tapering tips with narrow wings finely serrated at the edges, the central region being striated. The brush-shaped forms have slender shafts and about seven rather broad teeth distally. The spines pass to the front of the foot; the bristles are superior and in two groups, which diverge slightly from each other—with the cirriform lamella beneath—in the centre. In the example from the 'Porcupine' the spines are fewer, the bristles proportionally more slender, but also with narrow serrated wings, and the tips of the brush-shaped forms are longer and narrower, and the six or seven teeth appear to be more slender. In this form, moreover, the great inferior hooks begin about the 12th foot, whereas in the Neapolitan they do not appear till the 14th or 15th. In contrasting the hooks of the 20th foot, both have an upper more elongated and an inferior broader and stouter kind; but those of the 'Porcupine' form are considerably broader and shorter than in the Neapolitan. In the latter, both bristles and hooks extend to the posterior end of the body, three of the latter often occurring in a foot.

The gill in full development (Pl. X. fig. 2) forms a slender tapering pyramid with whorls of short pinnules from base to apex, and with two large blood-vessels, which also are

spiral in the preparation. A deep notch separates the basal segment of the cirrus from the distal. The setigerous region forms a short cone with the pointed lamella projecting obliquely backward behind it. It is stiffened by three fairly stout spines and bears superiorly a group of strong tapering winged bristles, the longest being dorsal. Bristles of the same kind with shorter and broader tips occur below the others. The ventral cirrus does not now project in profile, but has merged into the opaque glandular elevation running inwards from each foot, a short papilla in two of the succeeding feet, however, being present as a rudiment.

The change from the bifid ventral bristles with their indistinct articulation is coincident with the appearance of the branchia on the 5th foot, in which the branchial stem is remarkably large.

At the posterior part of the fragment from the 'Porcupine' the branchial stems are smaller, the dorsal cirri longer and more tapered, a straight powerful hook has appeared below the inferior bristles, and just above the slight projection marking the ventral cirrus is a still more powerful curved hook, also bifid and winged, which slopes obliquely downward and outward from the spines (Pl. X. fig. 3) and the separate hook (Pl. X. fig. 4).

It is not possible to contrast the entire series of branchiæ of the two forms, for that procured by the 'Porcupine' had only about thirty bristled segments, on the last of which the branchiæ still presented a spiral formation. In the Neapolitan specimens Grube gives fifty to fifty-six pairs as the number of the branchiæ, those examined in the present instance having respectively fifty-one, thirty-eight, and fifty, several of the last being simple filaments. Grube\*, moreover, states that the branchiæ arise on the 5th foot, whereas in all examined they began on the 4th foot. Claparède†, again, observes that the occurrence of the branchiæ on the 4th foot (fifth segment) is exceptional, just as their absence on the 5th foot is. As Claparède states, the first three feet bear long ventral cirri, the appearance of the branchia on the 4th being coincident with the presence of

\* Sitz. d. nat. Sect. Schles. Gesellsch., 20th June, 1877, Sep. Abd.

p. 7.

† Annel. Chét. Nap. p. 123. By the kindness of Mr. Cyril Crossland, an opportunity of examining six examples from Naples and others which he procured at Zanzibar was afforded. Considerable variation in the number of the branchiæ, their origin anteriorly, and in the occurrence of additional ventral cirri was evident. Mr. Crossland will probably allude more particularly to these features in his account of the "Annelids of Zanzibar."



the ventral pad (the first being a small one). The ventral cirrus, however, is represented by a minute conical process in front of the pad in the two following feet. In the same way the example from the 'Porcupine' has four long ventral cirri in front instead of three.

It is clear therefore that the small example procured by the 'Porcupine' is only a variety of Delle Chiaje's fine species, so abundant at Naples and elsewhere in the Mediterranean.

*Onuphis (Diopatra) brevibrachiata*\*, Ehlers?

Dredged in 358 fathoms; also east of Cape de Gatte, six miles off shore, in 60 to 160 fathoms. In the 'Porcupine' Expedition of 1870 the Station is not given, but it probably was between Stations 46 and 47.

A form having the appearance of *Hyalinæcia*, but readily distinguished by the presence of tentacular cirri and the condition of the branchiæ, which, however, rather lean to the type seen in *Eunice*.

The two frontal tentacles arise close together in the median line and form two rounded and somewhat flattened lamellæ in spirit. The five tentacles have the normal position, but they are much shorter than in *D. neapolitana*, though they also have an enlarged base, which is ringed. The tentacular cirri arise from the anterior border of the segment, are wide apart, and have a slightly fusiform outline—from a contraction at the base. The palpi form two flattened bosses on the ventral surface.

The first segment of the body is about the breadth of the succeeding. The dental apparatus is pale, a dark brown touch occurring at the tip of the posterior appendages of the maxillæ, whilst at the junction of these parts a triradiate band is present. The tips of the maxillæ and the teeth of the great dental plates are slightly brownish. The maxillæ are strongly curved, sharp-pointed, and rather abruptly swollen a little behind the middle. The posterior appendages are half-spoon-shaped, with a constriction at the base. The great dental plates have each about ten teeth. The azygos plate has ten. The right anterior curved plate has five; the left appears to have a larger number, but is broken. The mandibles have an oblique smooth edge anteriorly, and at the junction of this with the shaft, externally, is a projection.

The branchiæ commence on the 12th foot as a simple

\* Zeitsch. f. w. Zool. xxv. p. 49, Taf. iii. figs. 11-21.

filament attached to the dorsal cirrus a little above its base. As far as the 16th foot it remains a simple, long filament. The 17th foot has a branched branchial process, and at the 20th it has a single filament above the cirrus, and the terminal part is dichotomously divided—a feature of the species. At the 30th foot three divisions occur above the cirrus, which they considerably exceed in length, and then the tip is dichotomously divided into two still longer processes. The specimen terminated at the thirty-fifth segment, and on this, so far as could be seen in the injured preparation, the number of gill-filaments was not less.

The first three feet are much larger than the succeeding, and directed forward and outward as well as flattened laterally. Dorsally the 1st foot has a large and rather thick dorsal cirrus, which is bent downwards; into its base pass three spines. A bluntly conical setigerous region follows, having a short tapering papilla at the tip. No bristles are present. The ventral cirrus is of considerable size, somewhat fusiform in outline, and shifted so that it adjoins the side of the mouth.

The next two feet (2nd and 3rd) are similar in general structure, the size slightly increasing, and the ventral cirrus of the 3rd foot is both larger and more flattened. In none do bristles project beyond the skin, though they occur internally below the spines.

The 4th foot, like the foregoing, is more or less ventral in position. Its dorsal cirrus is large and subulate, the setigerous region has short bristles projecting from its edge, and the ventral cirrus is a lanceolate or conical lobe immediately beneath it.

A marked change occurs in the 5th foot, for conspicuous glistening bristles project from the setigerous region. The dorsal cirrus is somewhat less though still prominent, the setigerous region has a posterior flap, and the ventral cirrus is visible inferiorly as a short process. The dorsal bristles are translucent and finely tapered, with narrow wings and serrated edges, as in the feet behind. The ventral are equally translucent, have their shafts slightly curved and dilated at the bevelled end, from which a long tapering blade extends distally. The ventral cirrus is included in the low glandular pad behind the foregoing region, and the dorsal cirri diminish in size.

The 10th foot (Pl. X. fig. 5) has a subulate dorsal cirrus with a ventral "bite," followed by a swelling, from which it tapers to the point. It is supported by a group of slender spines. The setigerous region has two strong spines, the

blunt points of which pierce the tissues. A short flap also projects posteriorly. Superiorly is a group of long, translucent, very slightly curved, finely tapered bristles with narrow wings, which are serrated at the edge (Pl. X. fig. 6). The ventral bristles are equally translucent, have slightly curved shafts which are enlarged and bevelled at the ends for articulation with the long tapering terminal piece, which at the base is fully the breadth of the enlarged end of the shaft (Pl. X. fig. 9).

At the 20th foot these jointed bristles have disappeared, and their places are taken by two powerful yellowish hooks with bifid winged tips (Pl. X. fig. 10), which in outline resemble miniature pliers. The dorsal bristles have shorter tips with a more distinct bend at the end of the shaft. The two brown spines have increased in strength.

The 30th foot (Pl. X. fig. 7) presents little change on the foregoing, except in the branchiæ and the slightly increased slenderness of the dorsal bristles. The brush-shaped bristles (Pl. X. fig. 8) offer little peculiarity.

From the posterior end of the fragment projected a series of fibres, apparently formed by the glands of the annelid, and enveloped in a translucent matrix. The secretion is probably allied to that of *Panthalis*.

The example procured off Cape de Gatte had the same tough fibres projecting from its posterior (broken) end as in that form. Moreover, *Loxosomæ* occurred on many of the branchial processes.

This species approaches the *Diopatra brevibrachiata* of Ehlers, though no spiral line appeared on the branchiæ. Ehlers states that the first segment is broader than the succeeding, but in this form little difference between them was observed. The number of teeth on the dental plates is greater. It differs from *Onuphis Panceri*, Claparède, in the form of the anterior feet and other particulars.

A species apparently identical with *Onuphis Grubei*, Marenzeller, was dredged at Station 10 off Cape Finisterre in 81 fathoms during the 'Porcupine' Expedition of 1870.

The examples retained their madder-brown coloration in spirit. Thus the first five segments have each two bold touches of purplish brown on the dorsum, those on the first segment being double, viz., a large patch towards the anterior border of the segment with a smaller behind it. The spots in the others lie on each side of the middle line of the dorsum and towards the posterior border of the segment. A considerable number of segments following these have

four spots, also situated towards the posterior border of the segment, the outer on each side, generally the most conspicuous, being thus between the feet. Posteriorly the two median show a tendency to fuse, a pattern being by-and-by formed in the centre, whilst the lateral dark spots are as before. In some, three distinct bands are thus formed, as De St. Joseph\* observes.

A species which closely approaches the foregoing (*Onuphis Grubei*) comes from 92 fathoms on "Adventure Bank"—the shallow between the eastern and western basins of the Mediterranean, and extends between the African coast and Sicily—in the 'Porcupine' Expedition of 1870.

In external appearance it presents certain differences. Thus there are eight of the anterior segments with nine prominent feet instead of five or six. The tentacles and their long ringed ceratophores, however, have similar outlines and proportions to those of *O. Grubei*. The frontal tentacles appear to be somewhat larger, but the palpi agree.

The direction and proportions of the 1st foot agree with those of *O. Grubei*, and it carries a slender branchia on the dorsal cirrus. Dorsally are one or two simple tapering bristles, the wing of which is indistinct. A characteristic feature is present in the large inferior bristle, viz., the occurrence of two teeth below the bifid terminal region (Pl. XI. fig. 11). The pseudo-articulation of the tip and other features are similar to those in the more widely distributed form.

At the 10th foot the dorsal cirrus carries a branchia considerably longer than itself. The setigerous region forms a small cone, whilst the ventral cirrus is represented by a large projecting granular pad. The bristles are simple tapering forms without distinct traces of wings, though in some further back (Pl. XI. fig. 12) these are indicated.

The great hooks (Pl. XI. fig. 13), which by-and-by appear, have a powerful chief fang and a smaller superior fang, protected by wings. The middle of the hook is dilated. One of the feet from the middle of the body is shown in Pl. XI. fig. 14.

In the 'Porcupine' Expedition of 1869 an example of *Eunice fasciata*, Risso, was dredged in 80–110 fathoms on muddy sand with pebbles, probably off Valencia, though no Station is given. The same form was obtained at Station 10 in 81 fathoms off Cape Finisterre in the Expedi-

\* Ann. Sc. Nat. 7<sup>e</sup> sér. v. p. 193, pl. viii. figs. 57–58 (1888).



tion of 1870, and again off Cape Guardia. *Eunice vittata*, Delle Chiaje, was dredged in 92 fathoms on Adventure Bank, and in 45 fathoms off Cape Sagres in the Expedition of 1870.

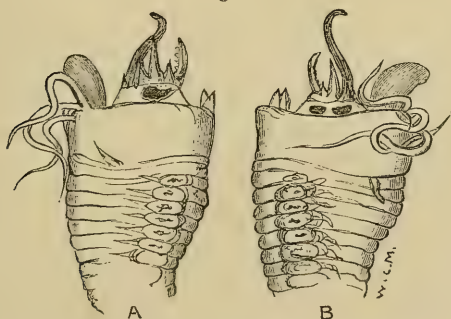
A form allied to *Eunice pennata*, O. F. M. (= *E. norvegica*, L.), was dredged in 539 fathoms on the Channel slope (Station 9) in grey mud in the 'Porcupine' Expedition of 1870. The chief points of divergence from the Norwegian examples are the more distinct eyes, the commencement of the branchiæ as a minute process on the 4th foot, and their cessation about the 34th foot. The small branchial process becomes bifid on the 6th foot, and continues more or less bifid to the 23rd foot, and ceases about the 34th foot. The shape of the foot also differs, and the separate small spines for the dorsal cirrus are more distinct. The two large brown spines of the setigerous region are longer and project more, and the ventral cirrus is longer. The dental apparatus agrees in appearance, colour, and structure with that of *E. pennata*.

*Eunice Jeffreysii*, sp. n.

*Habitat.* Dredged in 30 fathoms in Tangiers Bay on 2nd July, 1870. In the bottle beside it was a portion of the membranous tube, like that of a Terebellid, covered with minute sand-grains, fragments of shells, spines, and similar calcareous structures.

The head is distorted in the preparation by the extrusion of the proboscis, but it has a marked fissure between the

Fig. 1.



A, view of the right, and B, view of the left side of the anterior region of *Eunice Jeffreysii*. Enlarged.

palpi in front. The tentacles are normal in position, but they are remarkable for their slenderness. Two small but

distinct black eyes occur externally to the base of the longer posterior lateral tentacle.

Body probably three or four inches in length, but only about an inch and a quarter of the anterior end and a fragment half an inch long of the posterior region are present. It is flattened, like that of a *Marphysa*, and the segments are narrow. Little diminution seems to occur anteriorly. The first segment (peristomial) is broad, and is followed by a narrow one bearing the tentacular cirri, which are rather short and subulate.

*Proboscis*.—In extrusion (woodcut, fig. 1) the maxillæ are chocolate-brown, curved in a semicircle, and when viewed in profile they are sinuous and bend upwards at the tip. The great dental plates have four teeth, the first being longest, a large part of the edge behind being smooth. The antero-lateral plates have a blackish-brown patch externally in protrusion. The right has a long median fang with a bifid denticle ventrally, and a long tooth dorsally next it, besides a separate denticle or two dorsally. A single large blackish-brown patch occurs at the base. On the left are two small semicircular blackish-brown touches, the ventral being smaller than the dorsal. Dorsally are two long curved teeth attached to a separate base; then a curved lamina with a long curved fang and a smaller denticle beneath it, representing the azygos plate.

The mandibles have somewhat thick calcareous anterior plates with oblique cutting-edges sloping forward and outward from the middle line to the point, the outer slope being downwards and outwards.

The branchiæ commence on the 28th foot as a single short filament on each dorsal cirrus. In the anterior fragment of the body, comprising about 63 feet, they never attain more than two divisions, which are slender. In the posterior fragment three filaments exist in each.

Looked at generally, the feet are closely arranged—a feature due to the narrowness of the segments. The anterior dorsal cirri are thicker and more conspicuous than those to which branchiæ are attached, or apparently than those on the posterior region.

The 1st foot has a somewhat thick, subulate, dorsal cirrus of considerable length, a small bluntly conical setigerous process bearing a few short dorsal bristles above the spines, and below the latter are short compound bristles with moderately long tips. The conical ventral cirrus is proportionally long. Two dark brown spines support the

setigerous region, which appears to have a small papilla above it.

Whilst the dorsal cirrus, as mentioned, continues for some distance of considerable length and thickness, the ventral in the 2nd foot has diminished to a short conical process with a thickened base, and it is still further reduced posteriorly.

At the 10th foot (Pl. XI. fig. 15) the dorsal cirrus forms a long subulate organ, supported by several (three) pale slender spines which enter its base. At this region also ventrally is a slight prominence, which indicates the papilla developed in the subsequent feet. Two powerful brown spines, the tips of which project through the tissues, occur in the setigerous region, which in lateral view presents an oblique edge, sloping from above downward and inward—a feature largely due to the development of the posterior lobe or flap. Superiorly is a small clavate papilla which is directed forward and outward. It carries dorsally a series of rather stout, long, winged bristles of a pale brownish or dull yellow hue (Pl. XI. fig. 16). A slight bend occurs below the tip, which is comparatively short and abruptly tapered. They extend rather beyond the tip of the dorsal cirrus in the preparation. At their bases are a few brush-shaped forms (Pl. XI. fig. 17). The ventral bristles are paler (translucent and faintly yellowish), have a short thick shaft with a very slight bend, a faint articulation, and a long slightly tapered distal piece (Pl. XI. fig. 18). So far as observed this condition is characteristic of *Morphysa*, but is rare in *Eunice*. The ventral cirrus forms a short conical process at the tip of the large glandular ventral enlargement.

The 20th foot agrees with the foregoing, except that the papilla at the ventral base of the dorsal cirrus is larger. Two spines support the organ. The setigerous region has three black spines. The tips of both dorsal and ventral bristles are somewhat shorter. The edges of the terminal pieces of the ventral bristles are finely spinulose.

The outline of the 30th foot (Pl. XI. fig. 19) considerably differs. Branchiæ have now appeared. The dorsal cirrus is more slender, and opposite the papilla at its base ventrally a short branchial process projects dorsally, with a conspicuous afferent and efferent vessel. The setigerous region is now acutely conical, with a smaller rounded flap posteriorly. The tips of three strong dark brown spines project at the upper part. The dorsal bristles are more slender and longer, and with a slight bend below the

abbreviated tip. The brush-shaped bristles are distinguished by the great length of the teeth or processes at the tip, and one side is longer than the other. The ventral are similar to those in the 20th foot, the tips being minutely spinulose.

The 40th foot has a single branchial process, the dorsal bristles are more elongate, and the tips of the ventral bristles are knife-shaped, being short and acutely pointed. The serrations are less distinct. Two black spines support the foot.

The 50th foot has two divisions in the branchial process; the dorsal bristles are even more elongate, and the tips of the ventral shorter (Pl. XI. fig. 20). A strong bifid winged hook now projects above the ventral cirrus. A single black spine supports the foot. The glandular pad internal to the ventral cirrus is of large size. The tips of the dorsal bristles appear to be as minutely spinulose as those of the ventral, and the wings are marked by the usual striæ.

In the fragment of the posterior region of the body the male elements distend the parts. The feet have a rounded outline and three branchial filaments, the ventral papilla opposite their origin still being present. The foot has a single large spine, the tip of which pierces the surface between the dorsal and ventral bristles, a little above the short ventral cirrus. The dorsal bristles have longer and more slender tips, whilst the ventral have increased in strength, but no perfect example can be found. The foot thus possesses the strong simple spine and the strong bifid hook as levers, in addition to the bristles. The brush-like forms still have the same character as in front.

The *Lysidice multicirrata*, Claparède\*, from the coast of Normandy, has compound bristles with tapering tips, but it seems rather to lean to *Morphysa*.

In the 'Porcupine' Expedition of 1869 a form was dredged in 173 fathoms between Galway and the Porcupine Bank, which approaches the *Eunice amphiheliæ* of Roule†, but as there are certain divergencies it is necessary to go into detail. The head has the palpi deeply severed in front, and with a marked fold at their middle and the demarcation of an inner portion. The tentacles are unusually long, but retain their several proportions to each other. The median extends backwards to the tenth segment in the preparation. The tentacular cirri are about twice the antero-posterior diameter of the first or peristomial segment. They appear

\* Beobach. p. 60, Taf. xiv. figs. 23-26.

† "Campagne du 'Caudan,'" Ann. de l'Univ. de Lyon, 1896, p. 146, pls. xix., xx., xxiii., and xxv.



to have been smooth during life. They are thus all considerably longer than in Roule's form.

The body is probably about 10 or 12 inches in length, rounded anteriorly and somewhat flattened posteriorly where it tapers to the tail, which has two long and strong caudal cirri. The dorsal cirri are conspicuous anteriorly for their size and length.

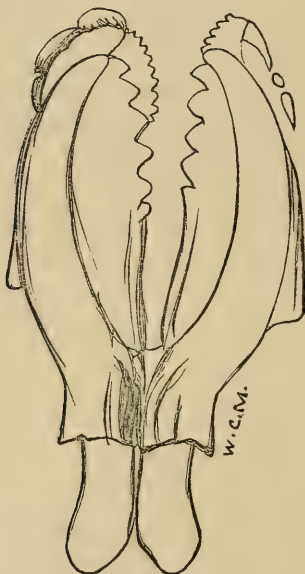
The branchiæ commence on the 7th foot as a tuft of three processes. At the 10th there are by dichotomous division five or six filaments proceeding from a common stalk, and thus differing from the semi-pinnate type. At the 20th foot nine divisions occur, the 25th eight, but three are formed by a bifurcation of the tip of one of the longer processes. The 30th has six, and they are now arranged in a semipinnate manner; the 40th has five; 50th, three; 60th, three; 70th, two; that before and that behind three; 80th, three. In the posterior region, again (of a separated fragment), an increase seems to occur, since four is the average number till within about half an inch of the tail. These branches spring from a common stem, and in the preparation spread over the dorsum, though sometimes three arise together and one separately. They continue almost to the posterior end, the 3rd foot in front of the tail having a single short branchial process.

In Roule's form the branchiæ commence on the fourth segment, and in the 40 to 50 anterior segments have about seven branches. In the segments behind these they diminish to four, three, and two to the posterior end. There are thus considerable differences in the number and arrangement of the branchiæ in the two forms, both anteriorly and posteriorly.

The maxillæ (woodcut, fig. 2) have a flat curve, only well-marked at the tips. They are deep chocolate-brown, and are boldly separated from the flattened spathulate appendages posteriorly. A double interlocking apparatus exists posteriorly, and the inner edge of each blade is sharp. Each fits into a hollow in the great maxillary plate, and thus the rigidity of the parts after seizing prey is maintained. The great plates have five strong teeth anteriorly, followed by one or two minor points, the edge behind (about half the length of the organ) being smooth. The left azygos plate has nine teeth, the curved plate in front of it five teeth, and the two continuation-plates a denticle each. The anterior curved plate on the right has ten teeth, and the continuation-plates—larger and smaller—a denticle each. The mandibles have two strong shafts which are slightly movable on each other, and are coloured blackish brown externally, paler

and marked by longitudinal veins internally. A marked shoulder occurs anteriorly, over which (ventrally) the cutting-plate extends backwards. On the inner (dorsal) surface the shoulder is boldly marked, the cutting-plate rising from each as a broadly lanceolate process with crenations on the anterior edge. The cutting-plates in certain examples seem to be easily detached, as if they were shed at intervals and renewed.

Fig. 2.

Dental apparatus of *Eunice phylocorallia*, F. Buchanan. Enlarged.

In Roule's description of the dental apparatus of *E. amphihelia*, Marion, the great dental plates agree in the number of the teeth (five). Unfortunately the nomenclature of the other parts is not conducive to perspicuity, for he adds that there are three denticles on each side, the anterior small and the posterior small, and that the anterior is devoid of teeth; the middle carries five and the posterior eight. As no mention is made of the azygos plate, considerable dubiety remains.

The anterior feet are characterized by the length of the dorsal cirri and the comparative length of the ventral in the first seven or eight. Thereafter the ventral become short processes of the great glandular mass at their base.

At the 10th foot (Pl. XII. fig. 21) the dorsal cirrus is still long, with a filamentous tip. It bears a branchial process of five divisions. The setigerous lobe forms a short cone, stiffened by two strong brown spines, the tips of which are free. The ventral cirrus is a short lobate process projecting from the thickened glandular mass internally. The dorsal bristles (Pl. XI. fig. 22) are simple winged forms rather abruptly pointed and with fine striæ and serrations on the edges. The brush-shaped bristles are characterized by their comparatively small terminal spikes (Pl. XI. fig. 23). The ventral bristles (Pl. XI. fig. 24) have shafts enlarged at the distal ends, bevelled and marked by oblique striations. The terminal piece is somewhat short with a bifid tip and wings.

At the 30th foot the setigerous region has two dark brown spines and six branchial filaments.

About the 33rd foot the great bifid ventral hook is observed piercing the surface, and at the 40th three powerful spines project from the setigerous region. The hook, which continues to the posterior end, is dark blackish brown, with a main fang and a small process or point on the crown (Pl. XI. fig. 24 a).

The great blackish-brown spines continue to the caudal region, where two only occur. In this region the large black ventral hook is present and has the same structure as in front. The dorsal bristles are very slender and elongate, and the brush-shaped forms are likewise long, though their structure does not differ. The jointed ventral bristles are similar to those in front, the tips being somewhat shorter. The ventral cirrus, like the dorsal, is comparatively long. This caudal region seemed to be in process of reproduction.

It is difficult to institute a comparison with the bristles figured by Roule, since the style of plate adopted, viz. black and white, does not lend itself to minute detail. A general agreement is all that can be said.

Accompanying the annelid were several fragments of a tough, pale, parchment-like tube minutely dotted under a lens. In structure it was minutely fibrillar, the result of fibrillation of the secretion.

*Eunicea labidognatha nuda* of Ehlers.

*Ninoe Kinbergi*, Ehlers.

*Habitat.* Dredged in the 'Porcupine' Expedition of 1870, at Station 10, off Cape Finisterre, in 81 fathoms. Head forming a blunt cone, comparatively broad posteriorly and occasionally slightly grooved inferiorly.

Body slightly tapered anteriorly, and more distinctly so posteriorly. Segments numerous and somewhat narrow in front, the first two devoid of feet, the second being narrower than the first. The form is readily discriminated from its allies by the remarkable condition of the feet to the 34th, and especially from the 6th to the 24th, since they project much further outward than usual and, moreover, show a digitate arrangement of the tip in the majority.

The proboscis has a pair of powerful curved maxillæ, which have a step externally and a contraction before the somewhat tapered posterior region. The great dental plates have seven sharp recurved teeth on one side and six on the other. A prominent curved fang is on the end of each of the antero-lateral plates. From the second (posterior) lateral plate a long horny band passes backward to the side of the great dental plate.

The mandibles are similar to those in the Canadian form.

The 1st foot has a short conical and vascular lobe and three brown spines. It bears a group of brownish winged tapering bristles. The second has similar spines and groups of brownish winged tapering bristles, which, like those of the 1st foot, are strong. The 3rd has three black spines and two groups of the same bristles. The lobe of the foot is lanceolate. The 4th foot presents four black spines and two groups of similar bristles, the dorsal, as usual, being somewhat longer. The lanceolate lobe of the foot (Pl. X. fig. 25) is now bifid at the tip, so that it resembles a partially split pear. In Verrill's *N. nigripes* a bifid process also occurs on this foot (3rd). The 5th has the separation between the two lobes better marked, and the upper lobe is longer, both, like the previous lobes, being vascular, a network of smaller branches connecting the larger and forming a reticulated central region in each lobe. The lower lobe, though shorter, is considerably broader than the upper.

At the 7th foot the bristles and spines remain the same. The upper lobe is larger, and the broad lower lobe has split into two at the tip, the upper being somewhat longer.

The 8th foot also has three lobes, the 9th and 10th four, but they vary in the several specimens, some at the 9th having only an elongated dorsal, and a short, broad, ventral lobe with signs of division at the tip; whilst the 10th foot had but three lobes. Four lobes are found at the 15th foot, with similar groups of tapering bristles, and four black spines. Moreover, about this foot two long winged hooks make their appearance between the dorsal and the ventral groups of bristles.



The 20th foot (Pl. XII. fig. 26) has five lobes, four black spines and two winged hooks between the groups of brownish bristles. The lobes appear to be modifications of the posterior lobe seen in other forms. The dorsal division or lobe is considerably larger and more massive than the others, and the rest form a slightly diminishing series, the two lowest springing from the same basal stem. The anterior lobe of the foot forms a truncated cone, the outline of which crosses the bases of the posterior lobes in lateral view. The elongated hooks (Pl. XII. fig. 27) have a moderately developed winged region, a short neck, a small main fang, and several minute points on the crown. In Ehlers's specimens only two black spines occur in this region. In Verrill's *N. nigripes* the lobate processes extended only to the 28th foot.

The 30th foot has six lobes, a dorsal considerably larger and longer than the others, a slightly diminishing series below, and a common trunk inferiorly which soon splits into two. Their vascular supply follows the arrangement seen in front, viz., a large marginal vessel with transverse branches and meshes. The dorsal bristles form two groups—an upper with moderately tapered tips, and a lower with very attenuate tips. One of the second series of the dorsal bristles is shown in Pl. XII. fig. 28. These are followed by the two winged hooks, and, lastly, two bristles with somewhat short tips occur inferiorly, and there are three black spines.

The 33rd foot has six lobes and two black spines; the 34th four lobes, two spines, and a hook; the 35th five lobes (the lower being small), one hook, and two spines.

The lobes diminish to three in the 36th foot, viz., an upper and two small inferior lobes. The upper dorsal group consists of about two winged bristles with moderately elongated tips, a lower series (two or three) with elongated and very finely tapered tips, one or two hooks, and a lower bristle; three spines are present. The 38th foot has only a single lobe and three black spines; two hooks are generally seen. The 39th foot has also a small lobe which becomes minute in the 40th foot, and both have only two black spines; the tips of the hooks are now shorter.

At the 50th foot only a blunt papilla indicates the upper (posterior) lobe. Dorsally the two kinds of tapered bristles are represented, and the winged hooks (three) are stouter and have shorter and broader winged regions. A minute chief fang occurs, then above it a series of still more minute points—from five to seven in number.

Coincident with the change in the posterior lobes, the feet

become less prominent and assume the condition seen in other forms.

Every specimen represented only the anterior third or less of the body, so that it would appear to be a dweller in mud or in a tube. The presence of largely developed glands at the bases of the feet would also seem to show that a special secretion is furnished either for a tube or for lining a tunnel.

The genus was established by Kinberg\* from specimens procured off the coast of South America. All the species he and subsequent observers (Ehlers and Verrill) have described have been American. This is the first appearance of the genus in European waters. Further remarks will be made under the Canadian examples.

*Lumbriconereis acutifrons*, sp. n.

Dredged in the 'Porcupine' Expedition of 1870, though the locality is not stated.

A small and imperfect specimen, distinguished by the attenuated conical snout (Pl. XII. fig. 29), which from a base of the normal breadth tapers to a delicate extremity. In lateral (profile) view it is even thicker at the tip than when seen from above, for the dorso-ventral flattening is less marked than in ordinary types.

The body is very little diminished anteriorly, and remains of the same diameter to the fractured region, the whole measuring about three-quarters of an inch. The dental apparatus is of a translucent madder-brown hue by transmitted light. The maxillæ are somewhat broad posteriorly with a concave border, but taper in front to strongly curved and sharp points. Their posterior appendages are narrowed after the articulation, then expand into somewhat long processes, having a straight inner edge and a convex outer edge; the whole appendage is thus unusually long. The great dental plates appear to have six strong, recurved teeth, each of which is connected by a canal with a brown band externally. These correspond respectively with the central canal of the tooth and the layer of odontoblasts of the dental matrix of Pruvot and Racovitza †, as shown in their account of *Lumbriconereis coccinea*. In front the preparation showed only a single plate with a tooth. The translucent mandibles were ankylosed in front, then split into the oblique dental edge which was tipped externally

\* Annul. nova, Freg. Eugen. Resa, p. 566, Taf. xviii. figs. 32 & 33

† Arch. Zool. Expér. 3<sup>e</sup> sér. vol. iii. p. 380, woodcut, fig. 3.

with brown. Nearly parallel lines passed from these blades into the shafts, where they converged. The apparatus had been injured. In glancing along the sides the feet project evenly, for the basal part forms (when looked at from above) a cylindrical process, the setigerous lobe forming the anterior or median region of the tip, whilst posteriorly is a short subulate papilla or lobe, sometimes probe-pointed, which is longest in the anterior feet.

The bristles are translucent and brittle, so that comparatively few remain on the specimen. The spines, of which there are four or more in the anterior feet, are also pale and translucent, the tips only being russet-brown. The dorsal bristles (Pl. XII. fig. 30) are slightly curved at the end of the shaft, the tip then dilating in the usual manner with its wings and tapering distally to a fine point, which in some is considerably prolonged. A few bristles, again, are of a more slender structure, dilating little at the end of the shaft, and being continued as a very attenuate hair-like tip (Pl. XII. fig. 31).

The hooks are likewise translucent and appear to be absent from the most anterior feet, though, as mentioned, they might have been removed. The shaft is curved backwards towards the tip and gradually dilates to the beginning of the neck of the hook, which (neck) is short (Pl. XII. fig. 32). The main fang in this region of the body is small, and the crown above it has several small teeth.

The form is peculiar, and probably came from a considerable depth.

*Lumbriconereis brevipes*, sp. n.

*Habitat.* Dredged at Station 10, in 81 fathoms, off Cape Finisterre, in the 'Porcupine' Expedition of 1870. A fragment of about 40 bristled segments.

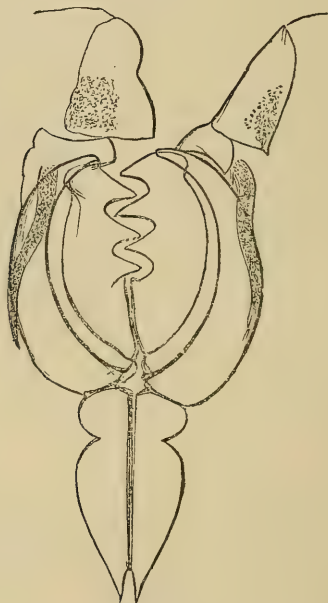
Head, as in other forms, conical, and with a median and two lateral grooves inferiorly.

Body gently tapered in front, the first two segments broader than the succeeding, and the first only very little broader than the second. The trim condition of the feet is a feature of moment, for the small posterior lobe is scarcely noticeable. The bristles stand stiffly outwards beyond the line of the feet.

*Proboscis.*—The maxillæ (woodcut, fig. 3) are curved in the usual manner and dark brownish. Posteriorly they are articulated to two processes which together form a broad spear-head, a constriction marking off the region near the

articulation. The great dental plates are well defined externally and posteriorly, the outer border in front having a projection so that, as the first tooth is opposite it, the apparatus is hammer-like. Each plate has three large and widely separated teeth which apparently interlock. The antero-lateral plates have each a single tooth, and the anterior plate is large, and by transmitted light is dotted with minute granules. The same dotted or file-like arrangement is seen in the band passing backwards from these to the lateral region of the maxillæ and great plates.

Fig. 3.



Dental apparatus of *Lumbriconereis brevipes*.  
The anterior lateral plates are displaced. Enlarged.

The mandibles form broad, flattened cutting-plates, the anterior edge of which is symmetrically notched, so that it resembles the tail of a fish. Dark pigment occurs on each outer section; longitudinal lines internally and looped lines externally mark its surface. The posterior processes are slender.

The anterior feet have a bluntly conical anterior lobe, whilst the posterior forms a small conical process which projects superiorly beyond the rest. Two or occasionally



three black spines support the foot. In the specimen only slightly brownish, long, tapering, winged bristles were present; but as all the inferior were broken, their condition is uncertain (Pl. XII. fig. 33).

About the 40th foot the posterior lobe or papilla becomes somewhat less, though of a similar outline, and the pale tips of the two black spines pierce a conical papilla anteriorly. Above the spines are two brownish winged tapering bristles as before, whilst beneath are three long hooks, the terminal winged region being rather short (Pl. XII. fig. 34). The crown of the hook is little developed and the main fang in this region is small; it probably increases in size posteriorly.

The *Lumbriconereis parva-pedata* of A. L. Treadwell\* from Culebra comes near this form; but as no description of the dental apparatus is given, the relationship is uncertain.

2. *On Canadian Eunicidæ dredged by Dr. Whiteaves, of the Canadian Geological Survey, in 1871-1873.*

Three species of Onuphididæ were procured: one, *Onuphis conchilega*, Sars (the *O. hyperborea* of Hansen), occurred in considerable abundance in 125 fathoms off Cape Rosier Lighthouse in the Gulf of St. Lawrence in 1871, and also on Orphan Bank in 1873. As a rule, the branchiæ commenced on the 11th foot. The tubes are composed of coarse gravel and flat fragments of Echinoids firmly fixed to the tough lining of secretion. Those from Orphan Bank are smaller and the fragments composing the tubes less coarse.

*Onuphis quadricuspis*, Sars †.

Dredged in 150 fathoms off Cape Rosier Lighthouse, Gulf of St. Lawrence, 1871, and between Cape Rosier and Cape Gaspé in 75 to 80 fathoms on a stony bottom, in 1872.

The head generally resembles that of other forms, but is eyeless in the preparations. The frontal tentacles are small and ovoid in outline. A patch of pigment occurs in the middle line posteriorly. The palpi form two prominent bosses inferiorly. The ceratophores of the tentacles are ringed, and the median is considerably shorter than the adjoining lateral.

\* "Polychæτους Ann. of Porto Rico," U.S. Fish Com. Bullet. for 1900, p. 198 (1901).

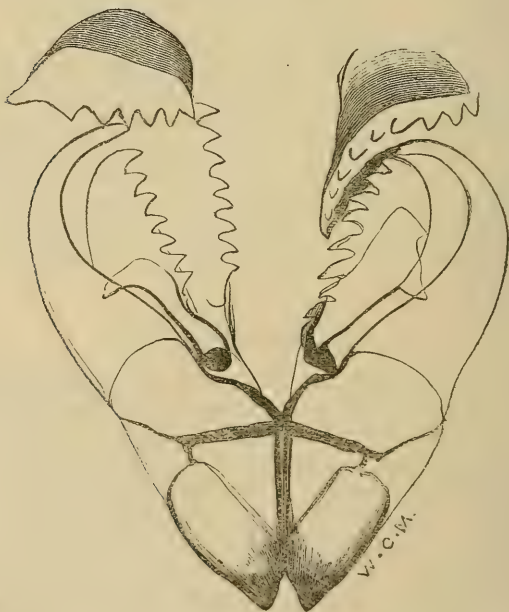
† Særsk. aftrykl af Vidensk.-Selsk. Förhandl. 1871, p. 407; and Bidrag til Kundskaben om Christianiafjordens Fauna, iii. p. 16, tab. xv. figs. 7-19 (1873).

The *body* is conspicuously banded with pigment, which was probably reddish brown during life, a bar occurring dorsally in the middle of each segment, generally with a darker spot in the centre. The first segment is somewhat narrower than the succeeding, and bears two subulate tentacular cirri at the anterior border.

*Proboscis*.—The whole apparatus is comparatively short, pale greyish in hue, marked with characteristic blackish-brown lines.

The maxillæ (woodcut, fig. 4) are remarkably broad posteriorly, curving almost from the latter border to the hook-like tip. A dark curved line indicates a separate edge or element at their posterior end, bounded posteriorly by another line running outward from the bold dark bar separating the maxillæ from their spatulate appendages, which have a median notch posteriorly. The great dental plates have

Fig. 4.

Dental apparatus of *Onuphis quadricuspis*, Sars. Enlarged.

each about six well-marked teeth directed backward. The right anterior curved plate has nine or ten teeth; the left has fewer, apparently about six.

The mandibles have an uneven sloped edge anteriorly and tapering shafts. A black pin-shaped bar occurs at the inner edge of each anteriorly. In one example, a new maxilla was developing after the manner of a new bristle or hook. The point is short and strongly curved. The functional maxilla of that side was perfect.

The next segment carries the first pair of feet, which are considerably shorter than in such types as *Hyalinæcia tubicola* and *O. conchylega*, and pass transversely outward instead of sloping forward to the anterior border of the head as in the forms mentioned. The dorsal cirrus is well developed and subulate; the button-shaped tip is minute, whilst a long subulate papilla extends from the posterior edge. The ventral cirrus projects as a subulate process ventrally. The setigerous region forms a short cone, supported by a group of spines with slender tips. The bristles (Pl. XII. fig. 35) are pale and appear to be hollow (or with fluid internally), have a distinct bend, and an incurvation on the concave side at the tip, which is bifid with long tapering guards or wings. Such a condition indicates a tendency to form a jointed tip. A few simple tapering bristles are also present.

The 2nd foot differs little from the 1st, though it and the 3rd have a more slender dorsal cirrus. The 4th foot has its ventral cirrus in the form of a pad. The four segments bearing the feet described form a region of the body characterized by broader and shorter segments. The succeeding segments are narrower and longer from side to side.

The branchiæ commence as a simple filament on the 6th foot\*. At the 10th foot there are two branchial filaments, and the setigerous region has now become a short cone. Dorsally is a tuft of simple tapering bristles with a slight wing, and inferiorly are two strong bifid hooks.

The 20th foot (Pl. XIII. fig. 36) has four branchial divisions, a tuft of slightly brownish dorsal bristles with a narrow wing at the tapering tip, and three strong bifid hooks beneath. In shape these differ from those found in *Onuphis conchylega* and *H. tubicola*. The shafts are powerful and both processes at the tip are strong, the secondary, however, being the more conspicuous. They are also winged (Pl. XIII. fig. 37). The highest number of branchial filaments seems to be four.

The 30th foot is less prominent and has two branchial processes. The dorsal bristles are considerably longer and

\* Sars does not mention the foot on which these begin.

there are two strong bifid hooks. The branchiæ cease about the 31st foot.

The posterior feet project little, forming smoothly rounded processes with simple attenuate dorsal bristles and two strong bifid hooks beneath. Only a single tail in process of reproduction was present, and it bore a single cirrus; but on this no reliance can be placed. Sars describes four anal cirri—two long superior and two shorter inferior cirri.

This species approaches so closely the *Diopatra socialis* \* of Ehlers from the 'Porcupine,' that, though Ehlers shows a strong bifid hook with the shorter prong broken (thus comparison is difficult), I am inclined to agree with Grube in uniting them. It shows also certain relationships to the *Onuphis eremita*, Aud. & Edwards, though in the latter the branchiæ arise on the 2nd foot.

In the bottle was a firm tube of reddish mud, lined by a tough mucous secretion, but it was empty. It probably was that inhabited by the species.

The bifid, or, as he calls them, bicuspid capillary bristles of the three anterior segments mentioned by Sars † have not been observed, but what he refers to is in all probability the tips of the tapering guards or wings of the special bristles shown in fig. 35, Pl. XIII.

This species is probably the *Nothria opalina* of Prof. Verrill ‡.

None of the American species described by Ehlers seem to approach this form, for if the bristles are similar the branchiæ are absent, and *vice versa*.

The third species, which may be the *Onuphis holobranchia* of Marenzeller, appears to approach *Onuphis Grubei*, Marenzeller, a form which comes near *Nothria tenuisetis* of the 'Challenger,' especially in the structure of the bristles, though there are certain differences, such as the origin of the branchiæ. It was dredged between Cape Rosier and Cape de Gatté, in 70 to 80 fathoms, amongst stones, in 1872, and in 100 to 212 fathoms off Anticosti, in the Gulf of St. Lawrence, in 1871 and 1873.

The *head* is characterized by the great length of the tentacles, the median, however, being shorter than the adjoining long posterior lateral. The anterior or short external lateral are, on the other hand, thick, with a marked distal filament, which is abruptly narrowed. This tentacle, moreover, is

\* Zeit. f. w. Zool. Bd. xxv. p. 46, Taf. iii. figs. 5-10.

† *Op. cit.* pl. xv. figs. 16, b, c.

‡ Amer. Journ. Sci. & Arts, v., Feb. 1873, p. 102.



divided by the long ceratophore into two nearly equal halves. All the others have long ringed ceratophores. The frontal tentacles are somewhat ovate and the pedicle is narrow. The palpi are separated by a distinct interval from the anterior border of the snout, and form two prominent, almost cylindrical bodies which have freer motion than usual.

*Body* probably 3-4 inches in length, somewhat like that of *H. tubicola* in contour, though differing in detail. The first segment is slightly narrower than the second and bears a slender tentacular cirrus at the anterior margin in each lateral region, the distance between them being proportionally great. Like the succeeding five segments it is narrower and more rounded than those of the flattened region following. The five feet and their processes are also larger and more conspicuous than the succeeding.

The *proboscis* is generally pale, with dark touches on maxillæ, accessory posterior plates, and other parts. The maxillæ (woodcut, fig. 5) have sharp, curved, dark points,

Fig. 5.



Dental apparatus of *Onuphis* near *holobranchia*, Marenzeller.  $\times 35$ .

and their accessory posterior plates are constricted, then dilated and pointed, so as to give them a regularly spathulate appearance. A bar of pigment separates them from the maxillæ in front, another is between them, and a shade also occurs at the constricted region. The great dental plates are boldly toothed; the right has eight teeth and the left seven. The accessory or azygos left plate has six teeth.

The anterior curved plate has nine teeth on the right, five or six on the left. A small isolated process with a tooth occurs externally. The oblique anterior edges of the mandibles have in some specimens irregular denticulations and a notch on each side internally with a dark band; in others the edges seem to be smooth. The shafts are slender and pointed.

The 1st foot has dorsally an elongated tapering dorsal cirrus, springing rather beyond the middle of the short foot, and which has a group of slender spines projecting into its base. Beyond the tips of these spines a long, slender, tapering (branchial) process arises from the dorsal edge, and is shorter than the cirrus, which, like the setigerous region, is permeated by a network of fine blood-vessels. None of the latter were seen in the branchial process. The setigerous region forms a blunt cone supported by four tapering spines, and with a long lanceolate papilla projecting from its posterior edge. The bristles are similar to those of *Onuphis quadricuspis*, but not identical, having hollow shafts (Pl. XIII. fig. 38) with a bend and wrinkles at the commencement of the terminal region, which has a hook at the end, followed closely by a secondary process, and then a single spike—two tapering wings which project beyond the tip guarding the whole. A subulate ventral cirrus arises near the base of the foot ventrally.

In its progress backward the dorsal cirrus has a tendency to diminish, whilst the branchial filament has a tendency to increase. Thus at the 10th foot (Pl. XIII. fig. 39) the branchial process is now the longer, though the cirrus has the larger base, a condition due mainly to the shrinking of the dorsal cirrus, for some of the branchial processes in front are really longer than that of the 10th foot. The setigerous region is now almost adnate, with a dimple in the centre, apparently the separation between the actual setigerous region and the adnate ventral cirrus. The papilla from the posterior border of the tip is also much reduced. Simple tapering bristles with scarcely a trace of a wing only appear. A group of spines pass to the dorsal cirrus as in front and the setigerous region has two strong spines.

So far as the specimens showed, the branchial filament increased in size, being the most conspicuous process of the foot, and still retained pre-eminence to the posterior end of the longest fragment, the dorsal cirrus being much smaller. Both diminished in size posteriorly, but the proportions held.

At the 20th foot the branchia is nearly twice as long as the cirrus, and its vascular trunks are conspicuous. The foot forms a slightly rounded projection, a dimple separating

the setigerous region from the pad formed by the ventral cirrus. Three strong spines with acute tips support the setigerous region. Dorsally is a group of simple bristles with a few brush-shaped forms, while ventrally are two strong hooks which have a stout shaft, and a large main fang with a process above it similar to that in the previous species.

The chief changes in the posterior feet are the diminution of both branchia and cirrus, the elongation and slenderness of the dorsal bristles, the increased strength of one spine, the point of which projects beyond the surface, and the occurrence of only a single powerful bifid hook.

It is noteworthy that the branchiæ do not attain great bulk in any part of the body, even the longest being rather slender, but their number probably compensates for their size.

This species constructs a tube of its tough secretion and envelops it with soft, greyish, and probably sticky mud.

The *Northia iridescens*, H. P. Johnson \*, dredged by Prof. Herdman at Victoria, B.C., so far as the description and figures go, is not distinguishable from this species.

The foregoing differs from the French examples of *Onuphis Grubei* by the absence of six or eight eyes behind the tentacles, by the fact that the branchiæ commence on the 1st foot, whereas in *O. Grubei* of the French coast they begin on the 4th segment. The alteration of the ventral cirrus in the Canadian form appears to be similar to that of the French, for the 7th foot has a truncated cirrus which soon becomes a rounded boss. The Canadian further differs in the number of teeth on the azygos plate and in other parts of the apparatus. De St. Joseph states that the bidentate strong hooks begin on the tenth segment. The relationship of this form with Marenzeller's *Onuphis holobranchia* is still undecided, as no opportunity of comparing the specimens has yet been available. It would appear to be closely allied, though having longer tentacles and apparently shorter branchiæ.

#### *Eunice* — ?

Dredged at Station No. 11, 1872, 30 miles N.E. of Cape Rosier, and at a depth of 200 fathoms.

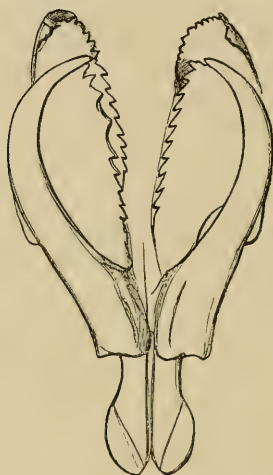
A species of considerable size, but only a fragment of the anterior region, comprising about thirty bristled segments with the head, has been received.

\* Proceed. Boston Nat. Hist. Soc. vol. xxix. no. 18, p. 408, pl. viii. figs. 86, 87, pl. ix. figs. 88-92.

The head is typical, with five moderately elongated tentacles and an eye of considerable size in the normal position on each side. The palpi are soldered, with the exception of a median notch in front and a deep furrow inferiorly. The first segment is about once and a half the breadth of the average anterior segment.

*Proboscis*.—The maxillæ (woodcut, fig. 6) from above

Fig. 6.



Dental apparatus of *Eunice* —? Enlarged.

present a moderate curvature, whilst in lateral view only a slight sinuosity occurs, the tips, however, rising clearly above the horizontal. The right great dental plate has ten teeth, the left eleven, but three of these were on a depressed region, probably indicating fracture and renewal. The azygos plate (left) has ten teeth. The left anterior curved plate had seven teeth, the right nine or ten teeth. The single accessory plate (anteriorly and externally) had one denticle. A marked shoulder separated the maxillæ from the posterior processes, which were spatulate in outline. The mandibles have large foliate dentary processes, with two or three small denticles on the oblique anterior edge. The shafts or roots are pale dorsally, with wavy lines as in sections of wood, whilst ventrally they are marked by a broad dark brown band. The colour of the apparatus is chocolate-brown with lighter parts here and there.



The second segment is slightly less than the others and bears the two tentacular cirri, which also are of moderate length. The third and fourth segments have feet devoid of branchiæ. The third foot has a branchial process of three divisions. The next branchia has more than double the number of processes, and they steadily increase till, at the tenth, their number is about twenty-six, at the twentieth twenty-nine (Pl. XIII. fig. 40). The last segment of the fragment, viz. the thirty-first, had branchiæ with twenty-eight divisions. The upper or last divisions of the branchia are more slender, especially the terminal process, which is only about half the diameter of the average filament. The main stem of the branchia is once and a half the diameter of the base of the dorsal cirrus. The dorsal cirrus is of considerable length, extending beyond the tips of the branchial divisions, but its diameter is less than that of the branchial stem. The setigerous region (Pl. XIII. fig. 40) forms a short cone with the edge sloping inward and downward.

The dorsal bristles are translucent, tapered, and curved at the tip, which has feebly developed wings.

The ventral bristles are also translucent and the end of the shaft is slightly curved, dilated, striated, and bevelled. The terminal piece is of some length and its base is less bevelled than usual in such forms (Pl. XIII. fig. 41), so that with the gentle narrowing at the tip (front edge) the process is somewhat spindle-shaped. The tip is peculiar, for after a notch it seems to taper away to a knife-point, a condition apparently due to injury. In certain views a differentiation into a bifid condition (extremely translucent) is clearly visible, the wings terminating in a delicate tapering point. The dorsal division of the fork is the longer and more robust.

The great brittleness of these bristles is a feature of note, comparatively few being perfect, and even these seem to have been recently regenerated. The majority present a fissured imperfect tip, the hooks having been removed. In some the tip, from splitting, is brush-like, in others the fracture of the terminal piece is abrupt (below the bifid region) and from the fractured end extends a simple process of the ventral edge.

The ventral cirrus forms a conical process projecting from the enlarged base (ventrally).

The head is irregularly four-lobed by a fold in the middle of the palpus in front of each antero-lateral tentacle, so that the form may fall under the *Eriphyle* of Kinberg as possessing tentacular cirri and a four-lobed frontal region, and thus its relationship to *E. violacea* is closer. The branchiæ have two

(the first) to thirty branches. It differs, however, in that the branchiæ begin on the 3rd foot, whereas in *E. violacea* they are absent on the first five. They lean to the type seen in *Eunice aphroditois* and *E. Rousseaui*.

This species also comes near *Eunice violaceo-maculata*, Ehlers, from Tortugas, but the head does not appear to be simply bilobate, the branchial filaments are longer and more numerous, and the number of teeth on the various plates is greater. The bristles, again, are quite different.

*Lumbriconereis fragilis*, O. F. Müller.

Great numbers, some of large size, were dredged in 1873 off Port Hood, Cape Breton; also in Gaspé Bay, 1873; some of these were also of large size. In one, the largest, the maxillary plates only had three teeth, the posterior apparently having been abraded, and the edges of the anterior were white. The anterior feet had the posterior lobe considerably modified, so that in lateral view it had a deep vertical edge instead of the more pointed condition in the ordinary forms. The black spines are also more numerous. There is, indeed, much variation in this respect and in the length of the bristles, but it seems unnecessary to do more than to draw attention to these differences.

*Lumbriconereis* near *assimilis*, M'I., but with pale spines.

A small species was dredged in 200 fathoms south of Anticosti in 1871 which had rather prominent feet, with a small posterior lobe, the tip of which in the sole example projects backward rather abruptly. The spines throughout are pale, and the bristles (Pl. XIII. fig. 42) do not offer cause for remark. The winged hooks occur on the first segment and are continued to the posterior end of the example, which is fragmentary. At the 20th foot the tips of the winged hooks are long and tapering (Pl. XIII. fig. 43), the crown of the hook having minute spines which do not much differ from the lowest or chief fang. Posteriorly the winged region is shorter and the chief fang of the hook better differentiated from the smaller upper spines of the crown.

This species comes near the *L. robusta* of Ehlers\*, though the spines in the latter are black.

The dental apparatus of this form had been crushed, and all that can be said is that the maxillæ had the normal outline, the curve being rather flat, and their posterior

\* Florida Annel. p. 104, Taf. xxxi. figs. 1-6.

processes were short and spatulate in outline, thus differing from the allied *Lumbriconereis zonata* of H. P. Johnson\* from Puget Sound. Each great dental plate had five strong recurved teeth, the first being the largest. The anterior plates had each a single tooth, the rest of the plate being minutely granular. The mandibles had broad, wedge-shaped, anterior plates with oblique edges and narrow fangs or posterior processes. The broad anterior plates were marked with curved lines.

*Ninoe Kinbergi*, Ehlers.

Dredged in considerable numbers off Port Hood, in 1873; probably in muddy reddish clay.

A small Lumbriconereid, probably about 4 inches in length, though none of the fragments measured more than 2 inches, with a diameter at the widest part in front (across the feet) of about 3 millim. The shape of the body is characteristic, since by the great breadth of the anterior feet a fusiform region is formed. The feet gradually increase in prominence from the 1st to the 6th or 7th, remain of considerable breadth to the 23rd or 24th, and again diminish.

The head forms a pointed cone, with a few wrinkles posteriorly, two of which are often conspicuous. The two succeeding segments and the rest of the body conform to the type in *Lumbriconereis*. The 1st foot has a setigerous process besides a short conical lobe with three brown spines and a dorsal group of simple winged bristles which slightly dilate beyond the shaft and taper to a fine point. Below the spines are two attenuated winged hooks, tapering towards the tip.

The maxillæ (woodcut, fig. 7) have a gentle curve and end in sharp points. The great dental plates have about six powerful recurved teeth. The two antero-lateral plates have each a single curved tooth, and at its base two small crenations, and a greater belt externally. These anterior plates have a different character from those in *Eunice* and *Lumbriconereis*, being folded flatly on the sides of the gape, the larger in front and the smaller behind. The posterior processes of the maxillæ have a constriction, then enlarge, and again taper off to a point externally.

The mandibles are shaped like a battle-axe, with a denticle towards the suture, the edge sloping obliquely outward and forward from this. The shafts are long and slender.

On the whole they resemble the European form and also the *Ninoe Kinbergi* of Ehlers from American waters; but the

\* Proc. Bost. Soc. Nat. Hist. vol. xxix. no. 18, p. 408, pl. ix. fig. 94.

dental apparatus differs from the latter in respect to the antero-lateral plates, which are described and figured by the author as curved plates having ten minute teeth, and with a granular band externally. Whether this difference is due to

Fig. 7.

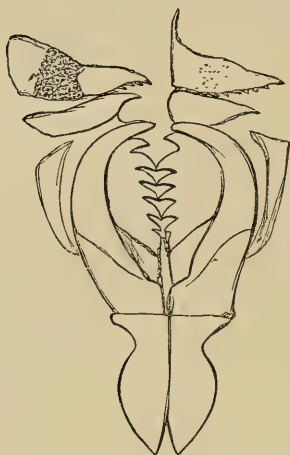


Fig. 8.



Fig. 7.—Dental apparatus of *Ninoe Kinbergi*. The points of the right anterior plates have been pushed to the right. Enlarged.  
 Fig. 8.—Anterior dental plate of *Ninoe Kinbergi*. Magnified.

structure or to a misinterpretation is an open question. Certainly the forms closely resemble each other, and the discrepancy is probably due to the difficulty in getting a good view of the parts. The base of the long pointed tooth in each plate seems to be flanked by a series of small teeth (woodcut, fig. 8).

The 2nd foot has a finger-like process extending beyond the posterior lobe, but the bristles conform to the arrangement already mentioned. The 3rd foot is similar; the 4th has three digitate processes, the upper being the longer; the 5th and 6th have each three processes; the 10th foot has six processes, the dorsal being the larger, and the foot is supported by three brown spines. The dorsal bristles are somewhat stout, have broad wings, and a short finely tapered tip; those of the inferior group have shorter tips. The hooks with the long tapered tips are as before.

The 15th foot presents posteriorly a long and somewhat subulate dorsal process and four shorter processes beneath it. In front is the setigerous lobe, which bears two groups of



the winged bristles, the tips of which have now become very attenuate. The winged hooks have still somewhat tapered and slightly bent tips. There are five brown spines.

There are some minor differences in the number of spines in the feet of the Canadian examples, but it has been thought unnecessary to repeat what has been given under those from the 'Porcupine.'

The 30th foot has three spines and six lobes, the upper being the larger. The cuticle on these seems to be specially thick. The dorsal bristles (Pl. XII. fig. 28) have a comparatively short winged region at the end of the shaft and a slender attenuate tip—which is almost as long as the shaft—beyond it. The inferior winged and tapering bristles are little altered.

At the 50th foot there are three brown spines supporting the setigerous region and a single short papilla representing the dorsal lobe. The tips of the dorsal bristles are still very attenuate and the winged region short. The hooks project far, have a broad and short winged tip, the widest part being just below the neck of the hook (Pl. XII. fig. 27), which is short. The main fang is little larger than the five or six points above it.

The species secretes abundant mucus, which mixes with the brownish mud amongst which it dwells. The secretion may readily line the tunnel in the mud.

Ehlers observes that all the examples of the genus procured by Kinberg and himself came from American waters. Besides the Canadian specimens the 'Porcupine' obtained others.

It is probable that the forms described by Ehlers and that by Verrill may have closer connexion than the former supposes. Verrill observes that the first two setigerous segments have branchiæ, whereas in the present the lobe appears on the second foot. His specimens came from Vineyard Sound and Buzzard's Bay, on muddy ground.

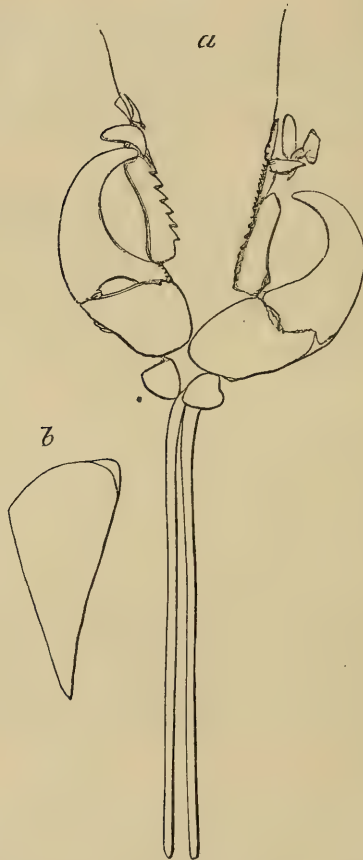
*Drilonereis canadensis*, sp. n.

Dredged off Port Hood, Gulf of St. Lawrence, 1873. A fragment of apparently the same form occurs in a bottle with *Nematonereis* in the British Museum, having been dredged in 40 fathoms off the coast of Cornwall by Laughrin (67. 1. 7. 29).

Head (Pl. XIII. fig. 44) when viewed from the dorsum forms a blunt cone, but laterally it is flat. Posteriorly the line of the head is convex, for it passes into a shallow crescent

cut out of the first segment. Inferiorly a median groove occurs. Body 5 or 6 inches long, very little narrowed anteriorly, remaining of nearly uniform breadth for a considerable distance, and then diminishing towards the tail, which is absent in the examples. The two segments behind the head agree with the Lumbriconereid type, the first being narrower

Fig. 9.



Dental apparatus of *Drilonereis canadensis*. *a*, maxillæ and dental plates; *b*, mandible. Enlarged.

dorsally (from the concavity in the centre anteriorly) and wider ventrally, where it has a series of longitudinal wrinkles. In spirit the body is rigid and moniliform, the feet projecting at the widest or median part of each segment.

The proboscis has superiorly a pair of short and strongly curved maxillæ (woodcut, fig. 9, *a*), which have the inner edge of the base posteriorly serrated, four or five points being present. They are continuous posteriorly with a short broad plate of the same blackish-brown colour, and marked off by a slight indentation, which again articulates behind with two triangular smaller pieces, continuous, after a constriction, posteriorly with two greatly elongated slender bars, slightly tapered posteriorly. The great dental plates are bar-like from above and are shorter than the curve of the maxillæ, though a process goes forward to the anterior plates. They have six recurved teeth, the anterior being longest.

The small antero-lateral plates are three in number, each with a prominent tooth, the larger proximal one having a shoulder below the tip.

The mandibles (woodcut, fig. 9, *b*) are triangular, blackish, broad horny plates which lie considerably in front of the anterior plates and ventralwards. The wide anterior end is rounded and they do not always touch each other.

The armature of the proboscis thus in many respects agrees with that in *Drilonereis*, which in all the examples seen possessed mandibles. The maxillæ are brittle, especially at the wide base.

The 1st foot has a small setigerous lobe in front and a conical lobe posteriorly. A pale stout spine pierces the upper part of the former. The bristles are broken.

At the 10th foot the setigerous region is better developed and bears a series of stout winged bristles with a marked curvature beyond the shaft and a tapering tip (Pl. XIII. fig. 45). A single powerful spine or hook-like spine projects inferiorly, the tip being simple. The tips of the winged bristles project inferiorly. The posterior lobe is now somewhat lanceolate in outline, its inferior border being convex.

The shape of the foot is little altered at the 30th, and the tips of the inferior bristles are as in front, viz., just projecting in profile beyond the posterior lobe. The tip of the great simple spine is conspicuous inferiorly.

At the 50th foot the posterior lobe is somewhat diminished (Pl. XIII. fig. 46), so that the tip of the great spine and the bristles are more prominent. The wings of the bristles are also narrower and the tips proportionally longer.

Posteriorly, whilst the tips of the bristles are more slender, the great spine has rather increased in size.

It is a very tough species, the cuticle resisting even considerable force, so that the bristles are apt to be injured in removing a foot.

This form comes near the *Drilonereis longa* of H. E. Webster\*, from the Virginian coast, though the concavity at the anterior border of the first segment and certain details of the dental apparatus differ. How much such differences are due to imperfection in figures is an open question.

It approaches the *Drilonereis Elisabethæ* of the British seas, though differing in details of the dental apparatus, in the broader wings to the less tapered bristles, in the shape of the head, and in the presence of the crescentic hollow at the anterior border of the first segment.

### 3. On Norwegian Eunicidæ collected by Canon Norman, D.C.L., F.R.S.

The Eunicidæ in this collection are in considerable numbers and of much interest, were it only for comparison with the British representatives. *Onuphis conchylega*, Sars, is not uncommon, yet *O. quadricuspis*, Sars, does not appear in the series, though it stretches to the shores of Canada and was formerly procured in Norwegian waters. The examples of *Hyalinæcia tubicola* are of medium size and show the occasional occurrence of a tentacular cirrus as an abnormality. The most abundant Eunicid is *Eunice pennata*, O. F. M., and several varieties occur. Amongst these is a small series in which the branchiæ commence on the 3rd foot. A single branchial filament is on the 8th foot, whilst the 12th branchia has 4 divisions, the 20th has 6 or 7, and the 30th 5 divisions, whilst the last, on the 39th foot, is a simple process as in front. The highest number of divisions observed was 10. This form seems to abound on shell-gravel, and it constructs tubes. *Eunice amphiheliæ*, Roule, is likewise common in its parchment-like tubes. Lastly, *Lumbriconereis fragilis*, O. F. Müller, is very generally distributed and of average size. Besides the foregoing, six or seven fragments pertaining to the group were dredged.

## EXPLANATION OF THE PLATES.

### PLATE X.

- Fig. 1.* Ventral bristle of the second foot of *Diopatra neapolitana*. × Zeiss oc. 2, obj. D.  
*Fig. 2.* Anterior (10th) foot of the same. The finely spiral branchia is not in good condition. Enlarged.

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\* Trans. Albany Inst. vol. ix. p. 40, pl. vii. figs. 84-88.



- Fig. 3. Foot of the same species behind the foregoing (about 20th). Enlarged.  
 Fig. 4. Powerful (lower) winged hook of the same foot.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 5. 10th foot of *Onuphis brevibrachiata*, Ehlers. Enlarged.  
 Fig. 6. Dorsal bristle of the same.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 7. 30th foot of the same. Enlarged.  
 Fig. 8. Brush-shaped bristle from the anterior region of the same.  $\times$  Zeiss oc. 4, obj. D.  
 Fig. 9. Ventral bristle of the same.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 10. Winged hook of the same from the 20th foot. Enlarged.  
 Fig. 25. 4th foot of *Ninoe Kinbergi*, Ehlers, the first of each group of bristles only being shown.  $\times$  Zeiss oc. 2, obj. D.

## PLATE XI.

- Fig. 11. Bristle of the 1st foot of *Onuphis* from Adventure Bank, allied to *O. Grubei*.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 12. Dorsal bristle of the same. Similarly magnified.  
 Fig. 13. Great winged hook of *Onuphis* from Adventure Bank.  $\times$  as before.  
 Fig. 14. Posterior foot of *Onuphis Grubei*, Marenzeller, 'Porcupine,' 1870. Enlarged.  
 Fig. 15. 10th foot of *Eunice Jeffreysii*. Enlarged.  
 Fig. 16. Dorsal bristle from the same foot.  $\times$  100.  
 Fig. 17. Brush-shaped bristle of the same.  $\times$  100.  
 Fig. 18. Ventral bristle of the 10th foot of the same.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 19. 30th foot of the same species.  $\times$  28 diam.  
 Fig. 20. Ventral bristle from the 50th foot of the same.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 22. Dorsal bristle of *Eunice amphihelice*, Roule.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 23. Brush-shaped bristle from the same. Similarly magnified.  
 Fig. 24. Compound bristle of the same from the 10th foot. Similarly magnified.  
 Fig. 24a. Jointed bristle from the 30th foot of the same. Similarly magnified.

## PLATE XII.

- Fig. 21. 10th foot of *Eunice amphihelice*, Roule. Enlarged.  
 Fig. 24b. Great winged hook behind the 50th foot of *Eunice amphihelice*.  
 Fig. 26. 20th foot of *Ninoe Kinbergi*, Ehlers.  $\times$  70 diam.  
 Fig. 27. Long winged hook of the same from the 20th foot.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 28. Dorsal bristle of the same (30th foot). Similarly magnified.  
 Fig. 29. Dorsal view of the anterior region of *Lumbriconereis acutifrons*. Enlarged.  
 Fig. 30. Dorsal bristle of the same from the anterior region.  $\times$  Zeiss oc. 2, obj. D + 3 in. draw-tube.  
 Fig. 31. One of the more slender series from the same region of the body. Similarly magnified.  
 Fig. 32. Shorter winged hooks from the middle of the body. Similarly magnified.  
 Fig. 33. Foot of *Lumbriconereis brevipes*. The dorsal edge is to the left.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 34. Long winged hook of the same. Similarly magnified.

## PLATE XIII.

- Fig. 35. Bristle of the 1st foot of *Onuphis quadricuspis*, Sars. It is accidentally curved.  $\times$  Zeiss oc. 2, obj. D.  
 Fig. 36. 20th foot of the same. Enlarged.  
 Fig. 37. Powerful winged and bifid hook from the posterior region of the same.  $\times$  as before.  
 Fig. 38. Bristle of the 1st foot of *Onuphis* near *holobranchia*, Marenzeller.  $\times$  as before.  
 Fig. 39. 10th foot of the same. Magnified.  
 Fig. 40. Foot (about 20th) of *Eunice* from Cape Rosier. Enlarged.  
 Fig. 41. Ventral bristles of the same.  $\times$  as before.  
 Fig. 42. Upper bristle of *Lumbriconereis assimilis*.  $\times$  as before.  
 Fig. 43. Winged hook of the same.  $\times$  as before.  
 Fig. 43 a. Head and anterior end of the foregoing. Enlarged.  
 Fig. 44. Anterior end of *Drilonereis canadensis*. Enlarged.  
 Fig. 45. Upper bristle of the same.  $\times$  as before.  
 Fig. 46. 50th foot of the same.  $\times$  70 diam.

VII.—On some Points in connexion with the ordinary Development of *Vaucheria* Resting-spores. By H. CHARLTON BASTIAN, M.A., M.D., F.R.S., F.L.S.

[Plate XIV.]

COMPARATIVELY few persons have probably followed the development of the resting-spores of *Vaucheria*, owing to the length of time they remain in a dormant condition. I have long been familiar with these bodies and with various changes that are from time to time apt to occur therein, but until the summer of 1901 I had never seen them germinate and give rise to young *Vaucheria* plants.

The only description of their germination that I have been able to find is that given by Pringsheim \*. He says:—"The spore remains for some time longer, without being thrown off from the parent tube on which it was produced; but the colour of its contents, which was at first green, gradually becomes paler and paler; the spore is at last rendered quite colourless and presents in its interior only one or more largish dark brown bodies. When it has lost all its colour it is detached from the parent tube in consequence of the decay of the membrane of the sporangium enclosing it. After some

\* "On the Impregnation and Germination of Algæ." Translation in Quart. Journ. Microsc. Science, 1856, p. 63, pl. iii. figs. 17-20. The figures, as reproduced in the Journal, and as copied in Cooke's 'British Freshwater Algæ,' are very crude, and even erroneous in several respects; this is especially the case with fig. 17.

time (in my experiments after about three months) the spore, which is readily recognizable by the red-brown nuclei in its interior, suddenly resumes its green colour, and immediately thereupon grows into a young *Vaucheria*, exactly resembling the parent plant. Close observation shows that the innermost layer, elongating, breaks through the thick outer membrane and becomes the young tube exactly in the same way as I have described the process of development in the germinating spore of *Spirogyra*.<sup>1</sup>

On May 8th, 1901, I had under examination a quantity of one of the larger *Vaucheria* which had been gathered a fortnight previously and placed with water in a shallow dish. Much of the weed had died, but on and among the filaments I found a very large number of resting-spores. A quantity of these were on this day placed in a small wide-mouth bottle, loosely covered with a screw cap, merely to exclude dust and diminish the amount of evaporation. The bottle was half-filled with water, and was then left, not far from a window, on the end of a mantelpiece in my study.

The bottle was at first opened only on two or three occasions for a brief examination of its contents. The spores were soon found to be undergoing the common kind of change—that is, were becoming decolorized into a whitish-grey mass of granules and vesicles, containing in its midst from one to four aggregations of pigment-granules. The pigment-heaps in this case were of a reddish-brown or reddish-orange colour, though very frequently the tint is found to be of a blackish green.

After an interval of several weeks, on July 4th, I examined the contents of this bottle again, and in the first portion of the deposit taken up with a pipette I found a number of the resting-spores germinating and giving birth to filaments. They were associated with other spores in their ordinary condition and others still in which different changes had been taking place.

Both the resting-spores themselves and the filaments that had grown from them were lined, sometimes pretty thickly and at others very sparsely, with bright green chlorophyll-corpuscles. In regard to the filaments, the most common arrangement was that the single process sent out almost immediately divided into two at a very obtuse angle; at other times the division took place at some distance from the spore, while occasionally two filaments were seen coming off from the spore itself close to one another. Subsequently they branched and changed in diameter in a very irregular manner.

The most remarkable facts, however, about these germinating resting-spores have had reference to the contained heaps of pigment, loosely spoken of in the foregoing translation from Pringsheim as "nuclei." The facts observed were so remarkable that I was anxious to repeat my observations in the following year, and this was done.

On June 8th, 1902, I found a quantity of *Vaucheria racemosa*, growing at the edge of a pond, which was absolutely crowded with resting-spores. Some of this plant was kept in water in a shallow dish, and after a day or two numbers of the spores were placed in a small stoppered bottle half-full of water. Another large quantity of spores was placed with water in a tumbler, and merely covered loosely, so as to exclude dust.

On July 24th—that is, only six and a half weeks from the date of gathering—many of the resting-spores within the stoppered bottle were found to have germinated, though at that date none of the spores in the tumbler could be found in this condition. Subsequent examinations made it clear that germination took place more rapidly in the closed bottle than in the open tumbler. I have no record of the date when I first found them germinating in the tumbler, but I can say that at the expiration of three and a half months hundreds of these spores were germinating, and that the process was seen occurring in others of them during the next two months.

It may not be out of place to say a few words now concerning the condition of these resting-spores in the long interval that occurs between decolorization and germination.

For a long time they remain, without apparent change, of a greyish-white colour, owing to the presence of an intimate mixture of colourless granules and corpuscles, the latter seeming to be derivatives or remainders from the green corpuscles with which the spores were originally packed. More or less in the centre a large mass of pigment-granules, mostly of a blackish-green colour (Pl. XIV. fig. 1, A,  $\times 250$ ), but sometimes of a red-brown or red-orange tint, as in *V. racemosa*, is to be seen. Three or four, or even more, smaller pigment-heaps, instead of one large one, are very common in this latter species. The largest number I have ever found is shown in B ( $\times 250$ ). It seems perfectly clear that these heaps of finely granular pigment are merely refuse products left over during the process of molecular transformation that the spore has undergone in becoming decolorized. Microscopical examination shows that they are mere heaps of fine granules, unsurrounded by any bounding membrane.



Now comes the question, what changes are undergone by the resting-spore in its ordinary condition, such as is shown in A, previous to its germination? It is very difficult to be certain as to this, but my impression, formed after the examination of very large numbers of these bodies, is that in the normal course of development the corpuscles indicated in A almost completely disappear and that the general substance of the spore becomes resolved into a uniform mass of very minute granules. The spore has then a rather glistening silvery-white appearance, such as was seen in B. In the specimen represented in C there was much the same silvery-white appearance, but there were indications that a new set of rather smaller spheres was forming, leading on to the production of small glistening spheres of protoplasm such as are shown in D. Thereafter these small spheres seem to become green and converted into small chlorophyll-corpuscles. A specimen of this kind is shown in E, but in an early stage, as the corpuscles were still only of a very pale green colour. Pringsheim speaks of "the innermost layer elongating," and says it "breaks through the thick outer membrane, and becomes the young tube." These two layers are distinguishable in E, which is, I believe, a spore becoming green and just about to germinate, while in fig. 3, D, the split in the outer membrane is recognizable.

Pringsheim further intimates that these latter changes are rapidly brought about. He says, after a time the spore "suddenly resumes its green colour, and immediately thereupon grows into a young *Vaucheria* exactly resembling the parent plant." As to the rapidity of these latter processes, my own observations do not enable me to make any definite statements.

I now come to the most interesting and important point of all in connexion with the germination of the *Vaucheria* resting-spore, namely, as to the fate of the pigment-heaps which all along have been such prominent objects in the resting-spores. During my first examination of these germinating spores and on all subsequent occasions I have found either in the green spore itself or in one of the filaments issuing therefrom one or more of the blackish-green or red-brown pigment-heaps now appearing (when not pressed together or squeezed within a filament) as perfect spheres with sharply defined outlines, such as are shown in fig. 2 ( $\times 250$ ). The most surprising thing at first was to see these pigment-spheres in the filaments, as in D and in E. The latter body is only enlarged half as much as the others, in

order to show the three unequal pigment-masses far away from the spore itself, and jammed together in the filament \*. Many of the spheres have been seen very much further away in the filaments than this, and many also have been seen just emerging from the spore, as in C, where the middle body is much compressed between the other two.

To casual observation these bodies all appear to be motionless; but after exposure for a little while to the light and heat from the microscope-lamp, very faint and more or less imperceptible movements can be detected in most of them. During my first study of these bodies, while examining a spore containing two of them, as in B, I saw one of the spheres moving forwards and backwards over a space scarcely equalling its own breadth without any visible change in shape, and with a slow gliding movement like that of an *Actinophrys*. But through the walls of the spore no rays of any kind could be detected then or since, though I have repeatedly watched their very slow movements taking place when these spheres have been within the spores and also within the filaments. Sometimes there has been a distinct interval between the forward and the backward movements; at other times it is clear that the movements of the pigment-spheres must be more continuous in one direction.

In October last I had under observation a spore in which within and just outside there were four unequal pigment-spheres, and also two others some distance away within the filament. This specimen is shown in Pl. XIV. fig. 3, A ( $\times 125$ ), though the two spheres close together in the filament are very indistinct, owing to their being out of focus. After I had taken this photograph, with a short exposure, I noticed that the movements of the spheres within and near the spore were more marked than usual. I left the specimen therefore exposed to the light and heat of the lamp (I was using no screen at the time) for exactly fifteen minutes, and then I took the photograph represented in B ( $\times 250$ ), with an exposure of three minutes. The results shown are most interesting. During the fifteen minutes' interval the lowest sphere had evidently moved considerably, though from the sharpness of its outline it is clear that it can scarcely have moved at all during the taking of the photograph. The small upper sphere had evidently moved less, though very perceptibly, during the interval, and had oscillated during the three minutes in which the photograph was being taken, as its

\* One of the two smaller bodies is flattened against the upper wall of the filament.

outline is so hazy and indistinct. The other small and the large sphere had moved comparatively little.

A rather large sphere of red-orange colour which was a long way out in a filament is shown in C ( $\times 375$ ) after it had been killed by a weak solution of formalin. The sharpness of its outline shows that all movements had been stopped. In some of the large spheres a very rudimentary development takes place. They no longer have the appearance shown in C; they seem to have grown somewhat, since around the heap of pigment-granules there is a rim of brownish-yellow protoplasm, such as is to be seen in D ( $\times 250$ ). This body is situated in an empty spore, whose outer membrane shows the rupture produced during germination.

On a single occasion only have I seen one of these pigment-spheres encysted. It was situated outside a filament from which it had been liberated\*. This specimen was in the first stock of these germinating resting-spores that was examined, and was found after the spores had been in my possession in a small bottle for five months. The cyst showed a rough tuberculated margin as in E ( $\times 500$ ), and the contents were of a blackish-green colour. Although this body was outside the filament, there was no room for doubt as to its nature.

I have now examined two or three hundred germinating resting-spores of *Vaucheria*, and in every one of them the original pigment-heaps have been seen in one or other of the conditions just described—each of them, that is, has been found to be included in a small mass of protoplasm which has been formed around it in some way during the stages immediately preceding the germination of the spore. So long as the spore has not sent forth any filaments we see more or less ill-defined aggregates of pigment-granules, this being the case even up to the stage almost immediately preceding germination, such as is shown in Pl. XIV. fig. 1, D and E. On the other hand, as soon as germination has taken place we find these pigment-heaps, spherical, sharply defined, enclosed within a scanty amount of protoplasm, and exhibiting slight powers of independent movement, which, as with other low organisms, are destroyed by weak solutions of formalin or osmic acid.

There cannot be a doubt, in fact, that we have to do with

\* The liberation is easily accounted for, as it very commonly happens that after a time the spore itself and one or more of the proximal segments of the filament die. All the chlorophyll-corpuscles of such segments disappear, while the membranes often become soft and disintegrated. The formation of dissepiments in both young and old filaments of *Vaucheria* is by no means uncommon.

the generation within the resting-spores of *Vaucheria* of independent forms of life of a very low order, resembling *Amœbæ* or the simplest forms of *Actinophrys*, but forms of life which are so heavily freighted with indigestible matter as to give them but a poor chance of undergoing further development.

*March 20, 1903.*—During the last three or four days I have again examined many specimens taken from the second batch of developed *Vaucheria* resting-spores contained in the open vessel. These examinations have been made after a long interval, and during this time much of the water had evaporated. Though rather more than ten months had elapsed from the date when the resting-spores were gathered, many of them were found to be still undeveloped. They were mixed with much débris from dead filaments, with empty cases of resting-spores, and with a large quantity of pale green *Vaucheria* filaments emanating from resting-spores which had germinated. Some of these filaments were still in continuity with, though others were separated from, the spores from which they had issued.

Each of the resting-spores in connexion with living filaments contained one or more of the pigmented Amœboid spheres. These were now found to be almost motionless, and none of them had wandered out into the green filaments. They were therefore probably some of the resting-spores that had recently developed, after long confinement under unfavourable conditions, with the result that the pigment *Amœbæ* were less active than those which had been produced at an earlier period.

On the other hand, many of the spores and filaments were dead, and from them all, or almost all, the chlorophyll-corpuscles had disappeared, though these filaments contained one, two, or more of the spherical *Amœbæ*, and many of them were in a more fully developed condition than any I had previously seen. The specimens had lapsed into a resting-stage and were perfectly motionless; but they were seen to possess a wider and more distinct border of protoplasm, stained of a slightly brownish colour, but free from pigment-granules. Some of these specimens, as in Pl. XIV. fig. 4, A ( $\times 375$ ), showed clear indications of a commencing segmentation of this peripheral protoplasm, while in others, as in B ( $\times 375$ ), segmentation had actually occurred into a number of minute monads, whose movements had to be arrested with a dilute solution of osmic acid before the photograph could be taken. Two or three of these monads (rather out of focus) may be



seen just escaping after rupture of the limiting membrane of the sphere.

In other specimens the change that occurred in these more developed pigment *Amæbæ* was different. No peripheral pigment-free protoplasm was developed, but a central nuclear mass of protoplasm, such as may be seen in C and D ( $\times 375$ ), was produced.

All these specimens, as I have said, were found in otherwise empty filaments—that is, in filaments denuded of chlorophyll-corpuscles. It is probable therefore that they were relatively old and were relicts of some of the earlier germinations.

I have only found a single specimen of the pigment *Amæbæ* in one of these more developed states while still contained within an old resting-spore. This specimen is shown in fig. 4, E ( $\times 375$ ), and it may be seen to represent a rather abortive attempt at the formation of one of the central nuclear masses.

Both these changes in resting *Amæbæ* are very familiar to me. They occur frequently in some other kinds of large *Amæbæ* which are apt to swarm in cells of *Nitellæ* and in *Vaucheria* filaments when these plants have been kept for a short time under certain unnatural conditions. These particular *Amæbæ*, however, grow most rapidly, while gorging themselves with chlorophyll-corpuscles. They then pass into a resting condition, and in the course of twenty-four hours or less many of them begin to segment peripherally into flagellate monads, while others, lying side by side with them, and therefore under similar conditions, for some mysterious reason go through the alternative process—that is, each of them gives rise to a single central sphere of protoplasm, which becomes surrounded by a membrane, and then remains in a quiescent condition for three or four months. After this long period the substance of the central mass of protoplasm also undergoes simultaneous segmentation into a number of minute flagellate monads or zoospores\*.

It seems clear, therefore, that the sluggish *Amæbæ* whose origin has been traced from the mere heaps of pigment-granules always present within the resting-spores of certain species of *Vaucheria* tend, after comparatively long periods, to pass through developmental phases of a kind so definite as to remove all doubt as to the fact of their being independent

\* These changes in *Nitella* and *Vaucheria* will be fully described in Part IV. of my 'Studies in Heterogenesis,' to be published about December next.

animal organisms, even though they have taken origin from the substance of the plant.

#### EXPLANATION OF PLATE XIV.

- Fig. 1.* A. An ordinary decoloured *Vaucheria* resting-spore.  
 B. A resting-spore of *V. racemosa* with many pigment-heaps and the substance generally composed of fine granules.  
 C. A spore very much like the last, but in which vesicles seem beginning to form again from the granular substance.  
 D. Another spore, in which the new vesicles are small and distinct, but colourless.  
 E. A spore almost ready to germinate, in which the small vesicles have taken on a pale green colour and the pigment-mass has become more defined in outline.

All  $\times 250$ .

- Fig. 2.* A. A spore which has germinated lined with small chlorophyll-corpuscles and containing a single pigment-organism.  
 B. A spore with two pigment-organisms and scarcely any chlorophyll-corpuscles.  
 C. A spore with three pigment-organisms making their way out into the filament.  
 D. A spore and filament, showing a large pigment-organism in the latter compressed into an ovoid shape.  
 E. Another germinated spore, showing a large and two small pigment-organisms far out into the filament and compressing one another, one being flattened against the upper border of the filament.

A, B, C, D,  $\times 250$ ; E,  $\times 125$ .

- Fig. 3.* A. A spore thickly lined with chlorophyll-corpuscles and containing four unequal pigment-organisms.  
 B. The same spore, more highly magnified, after an interval of fifteen minutes, in order to show indications of the movements of the organisms during the interval, during the period when this photograph was being taken, or during both these periods.  
 C. A large pigment-organism, far out in a filament well lined with chlorophyll-corpuscles, after it had been killed by a solution of formalin.  
 D. A more developed pigment-organism within an old spore, which, as well as the filament, was devoid of chlorophyll-corpuscles.  
 E. One of the pigment-organisms which has become encysted outside a filament.

A,  $\times 125$ ; B,  $\times 250$ ; C,  $\times 375$ ; D,  $\times 250$ ; E,  $\times 500$ .

- Fig. 4.* A. Two pigment *Amæbæ* in an otherwise empty filament, with a distinct margin of brownish protoplasm, showing some indications of approaching segmentation.  
 B. One of the *Amæbæ* in which peripheral segmentation into monads has taken place.  
 C & D. Two pigment *Amæbæ* in which a central nuclear mass of protoplasm has been formed.  
 E. An old resting-spore, containing a pigment *Amæba* in which there is an abortive attempt at the formation of a similar nuclear mass of protoplasm.

All  $\times 375$ .

VIII.—On the Relations between certain Diatoms and the Fission-products of a Parasitic Alga (*Chlorochytrium*).  
By H. CHARLTON BASTIAN, M.A., M.D., F.R.S., F.L.S.

[Plate XV.]

MUCH interest was excited in 1872 owing to the discovery by F. Cohn \* of an alga existing as a parasite in the thallus of the ivy-leaf duckweed (*Lemna trisulca*). This was followed in 1877 by the discovery of another parasitic alga by Prof. Perceval Wright † infesting various marine algæ. Since this time several other forms have been discovered, and rather an extensive literature has grown up concerning *Chlorochytrium* and allied genera. A key to some of this literature will be found in de Tonis's 'Sylloge Algarum,' vol. i. (1889) p. 636, in which an attempt was made to classify the various species then known.

Among the new forms there is one, *Ch. Knyanum*, found in *Lemna gibba* and in *L. minor*, which was examined and figured by G. Klebs ‡ in 1881. This is evidently the alga that I have of late met with very abundantly in both these species of duckweed, and to which my present remarks will refer.

I find during autumn and winter among duckweed from various localities many dead and decolorized leaves, having a greyish-white and somewhat gelatinous appearance. Such leaves may be easily picked out by spreading some of the duckweed in a thin stratum of water over a white dish. It will be found that the decolorized leaves are all devoid of rootlets, and possibly this loss of the rootlets may have been the main cause leading to the premature death and change in the appearance of the leaves.

Examination with a hand-lens, magnifying eight or ten diameters, will show in many of such leaves that the upper greyish-white surface is flecked with minute specks of an emerald-green colour, sometimes abundantly and sometimes sparsely, while examination of these or other leaves under the microscope will often show an abundance of the early stages of such bright green specks, so minute as to have been invisible with the mere hand-lens.

It is best to pick out the smaller leaves for microscopical

\* 'Beitrage zur Biologie der Pflanzen,' Heft xi. p. 87.

† Trans. Roy. Irish Acad. vol. xxvi. p. 13.

‡ Botan. Zeitung, 1881, p. 248, t. iii. figs. 11-15.

examination, and even then (especially with *L. gibba*) the examination can often only be satisfactorily carried out by placing one of the leaves in water on an excavated glass slip (taking care that its upper surface is uppermost), and gently compressing the leaf, if necessary, with the cover-glass.

An examination of a very large number of these infected leaves has enabled me to ascertain the following facts:—

The very active spores of the *Chlorochytrium* penetrate to some of the intercellular spaces of the leaf through the stomata. Single spores or such bodies after a primary fission may be seen just within the stomata (Pl. XV. fig. 1, A). Sometimes the entire spore or the segments of the once or twice divided spore will grow considerably before undergoing any further fission (as in B), though more commonly division goes on so as to produce eight or more cells (C), which, as they grow, soon become tightly packed within the now dilated substomatal space (D). Examination of the surface of the leaf over one of these patches will always reveal a stoma greatly dilated and almost circular in shape\*.

The mode of infection in *L. minor* and *L. gibba* is therefore altogether different from that described by Cohn as occurring in *L. trisulca*. In that species of duckweed there is, curiously enough, an absence of stomata. The average shape and appearance of the patches of *Chlorochytrium* in *L. trisulca* is also rather different from that of the patches in the other two duckweeds, and the latter patches also lack the distinct and often thick bounding membrane which occurs round the patches in *L. trisulca*.

In each of the forms the tendency is to an ultimate production of minute spherical or ovoidal zoospores, which, after exhibiting a swarming movement, may make their way out of the space in which they have been developed. It often happens, however, in each of these forms of *Chlorochytrium* that the zoospores may, either in whole or in part, not succeed in escaping, but come to rest within their respective cells or spaces (fig. 2, B,  $\times 375$ ).

What I have further to say refers especially to *Ch. Knyanum*, and to this form as it occurs in *L. gibba*.

In some of the smaller patches composed only of two or of four enlarged cells it may occasionally be seen that segmentation of the contents of one of the cells only has occurred, while others have remained unaltered. This same kind of independence in the life of the cells occurs also in larger

\* All the components of figs. 1, 2, and 3 have been magnified 250 diameters except fig. 2, B; this latter, as well as all the components of figs. 4, 5, and 6, have been taken at a magnification of 375 diameters.



aggregates, some of the individual units of which may often be seen entire and undivided, while the contents of others are in different stages of fission down to the final stage of spore-formation.

It seems probable that sometimes the swarm-spores are formed by a simultaneous segmentation of the cell-contents into the brood of spores, but in other cases, as was clearly shown by G. Klebs\* for *Ch. Lemnæ*, the cells undergo successive processes of fission till the swarm-spores are produced. This latter kind of process I have found to occur very abundantly in *Ch. Knyanum*.

Multitudes of partially empty spaces may be seen containing large or small specimens of these intermediate fission-products, those within the same space being either all of one size (fig. 2, C) or of very different sizes. Other spaces may be seen still full and distended with *Chlorochytrium*, the constituent cells of which exhibit very different degrees of segmentation (fig. 2, A). Some have become resolved into the minute zoospores (fig. 2, B), while others have remained as fission-products varying much in size. Some writers have spoken of some of the larger forms as being probably "resting-spores."

It seems to me, however, that it can only with certainty be said that the *Chlorochytrium* cells undergo processes of division to a variable extent, so as to yield fission-products of very different sizes, and that, presumably under the influence of some unfavourable conditions in their environment, some of the products at each of these stages may undergo no further changes of a normal kind, and thus may never give rise to *Chlorochytrium* spores.

This brings me to one of the important points which this communication is destined to make known, which is, that in the later stages of the life of *Ch. Knyanum* the fission-products within the intercellular spaces of the leaf are often found to be more or less intermixed with diatoms, varying not a little in size and in shape.

This association is met with sometimes in spaces none of the contents of which have escaped, and then the contrast is great between the beautiful emerald-green of the alga cells and the brownish-yellow colour of the diatoms mixed therewith. At other times partially empty spaces are seen containing the fission-products of the alga alone (Pl. XV. fig. 2, C), diatoms alone (fig. 2, D), or a mixture of the two kinds of units (fig. 3, A, B, C, D).

\* *Loc. cit.* Taf. iii. figs. 10, a, b, c.

More rarely spaces are found densely packed with brownish-yellow diatoms only, in different stages of growth and development, except perhaps for the association of one or two minute algaoid corpuscles (fig. 4, A, B, C, D) \*.

In regard to the diatoms themselves, these are sometimes very small and rudimentary (as in fig. 3, A, and in the upper part of D), but at others they are much larger (as in fig. 3, B, C, D). These larger sizes are either fairly broad and ovoid, like *Naviculæ*, or else narrow and elongated, like *Nitzschia* (fig. 4, C, D).

In almost all cases, however, the diatoms have the appearance of being immature; they have ill-developed siliceous envelopes and are all quite full of brownish-yellow endochrome. There are also at times indications that growth and multiplication of these immature forms is or has been taking place, looking to the way in which they are occasionally ranged side by side in short rows in some of the half-empty spaces (as in fig. 3, A, and in the upper part of D).

The substomatal spaces which have been tenanted by the *Chlorochytrium* are characterized, as I have said, by a greatly distended and almost circular stoma, and often by having their walls stained of a more or less distinct rust-colour. Indications of the latter change are to be seen in fig. 2, C, D†. It is a fact of much importance that diatoms are never to be found in any of the substomatal spaces except in those which either actually contain or bear marks of having been previously tenanted by *Chlorochytrium*.

Unfortunately I have found it very difficult to photograph some of the most remarkable specimens I have met with. This has been due to a combination of causes. It has been partly owing to the light having to pass through the whole thickness of the leaf, partly because of the staining of the walls of the spaces, partly because the photograph yields no discrimination in shade between the emerald-green colour of the alga and the characteristic brownish yellow of the diatom, and at other times owing to the diatoms being so densely packed within their little subepidermal pockets that their individual forms cannot be clearly shown, as in fig. 4, in which two of the spaces (C and D) were closely packed with

\* The specimens shown in this figure looked much more densely packed before the leaves from which they were taken were immersed in glycerine in order to facilitate the taking of the photographs. All the other photographs have been taken from leaves immersed in water only, except fig. 6, A, which was also taken from a specimen in glycerine.

† Of course these two characteristics, belonging to different planes, can never be seen together in the same photograph.

small but long and slender diatoms like *Nitzschia*, while fig. 3, C, D, contained broader and more ovoid organisms of the *Navicula* type.

It occasionally happens that the spores of the *Chlorochytrium* force their way from a closely packed space in which they have been produced, whence exit is not easy, in between various of the contiguous sub-epidermal cells, and occasionally in these situations I have also found diatoms. Spores in these situations between the spherical cells are shown on the right side of fig. 1, D.

There is another point of much interest to be mentioned.

Sometimes one of the epidermal cells, of zigzag outline, will here and there be found filled by a light green alga having the appearance of being a species of *Chlorochytrium* (fig. 5, A). Other of these cells may be found in which such bodies seem about to undergo fission into several smaller cells (fig. 5, B), and others still in which the original cell has divided into small green ovoid products (C) or into a number of more minute zoospores. In one case such zoospores were seen to have assumed a yellow colour and some of them seemed to be elongating, as was the case with some of the segments shown in fig. 5, D. Many other of these isolated epidermal cells have been found containing either small ovoid diatoms only (fig. 5, F) or a mixture of such diatoms with green fission-products as in fig. 5, E—just as I have found the two kinds of bodies associated in the much larger sub-stomatal spaces.

The diatoms in the epidermal cells are always small, commonly of about the same size, but not invariably so, and mostly having the appearance of being minute *Naviculæ*.

How the *Chlorochytrium* spores obtain an entry into the epidermal cells I am unable to state; but being actively motile, it would clearly be much easier for them to get in than for the diatoms to do so.

It seems most probable that it is the spores of *Ch. Kny-anum* which infect these epidermal cells, and it seems possible that they may penetrate them from a substomatal space, as I have often, though by no means invariably, found such infected epidermal cells just over, or by the side of, one of these spaces.

What interpretation is to be given concerning the association of the diatoms with the *Chlorochytrium* fission-products?

Only two possibilities seem to present themselves:—

(a) The diatoms have, like the algæ, obtained entry to the subepidermal spaces through the stomata.

(b) The diatoms have been produced *in situ* by a transformation of the fission-products of the alga.

The first of these possibilities it will be convenient to speak of as the Infection Hypothesis and the second as the Transformation Hypothesis.

(a) *Infection Hypothesis*.—The difficulty in accounting for the facts seems to me to be extreme in accordance with this supposition, especially if we bear in mind what is authoritatively known concerning diatoms. The important points are these:—

1. No *motile* spores are known, and previous to 1896 there was no certain knowledge concerning the existence of spores of any kind in diatoms. The important discovery by George Murray of undoubted spores or germs, originating by a process of rejuvenescence, in species belonging to three marine genera \* constitutes all that is certainly known at present on this subject.

2. It is commonly stated by writers that individual diatoms do not increase in size †, increase in bulk of diatoms being only brought about as a result of "conjugation," which is admitted to be a comparatively rare process.

3. Previous to the above-mentioned discovery by George Murray diatoms were said to be formed only (a) by a process of "conjugation" or rejuvenescence, or (b) by fission, which is the common process, and one that involves a very slight diminution in size of the products ‡.

Such facts concerning diatoms in general must be borne in mind in conjunction with these others more specially bearing upon the question now under consideration.

4. The substomatal spaces which either are or have been tenanted by *Chlorochytrium* probably constitute much less than 10 per cent. of those existing on most leaves of the duckweed, yet no diatoms are ever to be seen in the other 90 per cent. of the substomatal spaces.

5. The purposeless to-and-fro movements of some diatoms when free in a fluid, and their absence of movement when lying on the surface of a leaf, seem quite incompatible with the notion of their selective penetration through certain special stomata only.

6. A point of still greater importance is the fact that

\* Proc. Roy. Soc. Edinb. 1896-97, p. 207.

† Wolle, 'Diatomaceæ of North America,' 1890, p. 11; Smith's 'British Diatomaceæ,' vol. i. 1853, p. xxiv, and 1856, vol. ii. p. vii; and Pritchard, 4th ed. 1861, pp. 58, 61-63.

‡ Wolle, *loc. cit.* p. 11.



diatoms are never to be seen in the spaces in which the *Chlorochytrium* is in one of its early stages of development; they are to be found only in association with its later stages, where some of the final segmentations have been taking place, and often where the patches are so old that the walls of the spaces containing them are stained of a rust-colour.

7. None of the diatoms found either within the spaces or within their ramifications between surrounding cells have ever been seen to move.

8. Moreover, where the diatoms exist they are often intimately intermixed with the algoid cells; they are also to be seen in the peripheral regions of spaces, even when these are still full, and small specimens are likewise to be found between the spherical subepidermal cells contiguous to the invaded space. Such facts are incompatible with an entry of diatoms from without, especially if we bear in mind what has been said under the last two heads.

9. Again, where the diatoms exist they not only vary much in size and shape in different spaces, but even within different regions of the same space.

Taken as a whole these various facts seem to me absolutely to negative the Infection Hypothesis as a means of accounting for the association of the diatoms with the fission-products of *Chlorochytrium* in the subepidermal spaces.

(b) *Transformation Hypothesis*.—The facts which are so incompatible with the foregoing hypothesis will be found either to offer no difficulties to, or to be capable of receiving a ready explanation in accordance with, the transformation hypothesis. This hypothesis is also strengthened by other facts not previously referred to.

1. The absence of the diatoms from the 90 per cent. of the substomatal spaces which are not infected by the algæ is explained.

2. The absence of movements on the part of the diatoms in question affords no difficulty.

3. The absence of the diatoms from the *Chlorochytrium* spaces during the early stages of the development of the alga affords no difficulty and is explained.

4. The variation in the size of the diatoms is explained, in the main, by the varying size of the fission-products of the alga. The two kinds of units very commonly coexist, and where the algoid cells are small the diatoms are small, where they are of medium or larger size the diatoms are similarly of medium or larger size. Such variations in the size of the algoid cells are very common within the same infected space,

and then, when diatoms are present, they are also of various sizes.

5. Old, partially empty, spaces are often to be seen containing the *Chlorochytrium* fission-products, small or large; others may be found containing diatoms, small or large; and others again partially empty, but containing a mixture of the alloid fission-products with diatoms of a corresponding size.

6. Other spaces still densely filled will show, with the alloid cells, diatoms either packed in their midst or occupying the boundaries of the spaces, and often differing greatly in size in the two situations. They are likewise to be found occasionally in the narrow spaces between contiguous spherical cells, where, as I have said, alloid spores from the parent brood not unfrequently penetrate.

7. In the spaces where the alloid cells and the diatoms are mixed some of the cells may be seen to have assumed the brownish-yellow colour of the diatoms, and some of such cells may also be seen more or less elongated and apparently developing into diatoms.

8. The majority of the diatoms have an immature appearance. The siliceous envelope in the great majority of them seems to be either absent or very imperfectly developed, and unmistakable evidence that multiplication of these immature diatoms has taken place is frequently to be seen\*.

There is no probability, and no one, I think, is likely to maintain, that diatoms are normal phases in the life-history of this parasitic alga; and as a careful consideration of the evidence as a whole appears utterly irreconcilable with the infection hypothesis, we seem unavoidably driven to the conclusion, which is so congruous with all the facts, that the diatoms in question are heterogenetic products actually produced by the transformation of the cells of the alga, alike in the substomatal spaces and in the epidermal cells.

I include the epidermal cells in this statement, because

\* Some of the differences in size, apart from differences in the size of the alloid fission-products from which the diatoms have originated, may be due to increase in bulk of these immature organisms. Although this is at variance with commonly received views, it is in accord with the observations of George Murray, who says (*loc. cit.* p. 216) that young diatoms formed within a parent by a process of rejuvenescence when liberated by "the separation of the parent valves at the girdle may grow, divide, and multiply before fully attaining the characteristic external sculpturing and adornment of the parent." Young diatoms originating in fresh water may find silica in all pond-water. The ammonia contained in main-water, like other alkalies, easily dissolves silica or aluminium silicate when in a finely pulverised state, and one or other of these compounds is to be found in all soils (see Prof. Edwards, "On the Solubility of Silica," *The Chemical News*, Jan. 1896, p. 13).

almost all that has been said against the infection hypothesis and in favour of the transformation hypothesis as accounting for the presence of the diatoms in the substomatal spaces holds good also in regard to their presence in the epidermal cells. In one respect the argument is even stronger in its application to them, since there is much evidence to show that diatoms are only found in those epidermal cells which are or have been tenanted by the alga, and such infected cells never constitute more than the smallest fraction per cent. of those existing on the whole upper surface of a leaf.

A further point of extreme importance is to be found in the very great differences in the size and shape of the diatoms, according as they originate from the small or the larger algal fission-products. Yet these variations, for which no other contributory cause is apparent to us, are so great that botanists unaware of the origin of the diatoms, and finding them in the *Chlorochytrium* spaces, would almost certainly regard some of them as belonging to different species of the same genus, and others even as representatives of distinct genera. This, however, is a subject which must be left for future investigation.

It was suggested to me by a distinguished botanist, to whom I showed some of the specimens of duckweed containing in their substomatal spaces and epithelial cells mixtures in various proportions of *Chlorochytrium* segments and diatoms, that their association might be explained by the Infection Hypothesis, backed by the assumption that *Chemotaxis* had been in operation, which in this case would mean that the physico-chemical processes associated with the growth and multiplication of the algæ within the spaces were capable of giving rise to products exercising an attractive influence upon the diatoms.

It was not pretended that there was any direct evidence in favour of this assumption; it was advanced as a possible explanation and merely to stave off the conclusion, otherwise inevitable, that the diatoms had been produced by the transformation of the cells of the alga.

A careful and unbiassed consideration of the following facts will, however, I think make it plain that the evidence is overwhelmingly against *Chemotaxis* and the Infection Hypothesis:—

1. *Chemotaxis* can only be supposed to operate at short distances; but such diatoms as are found within the spaces are never to be seen on the surface of the duckweed.

2. The diatoms that are commonly met with on the surface

of the thallus (a comparatively large *Navicula* and a *Cocconeis*) are never found within the substomatal spaces or the epithelial cells.

3. Chemotaxis implies a direct power of movement in response to an attractive influence; but none of the diatoms on the surface of the duckweed within the spaces or within the epithelial cells have ever been seen to move.

4. The diatoms in the spaces are found intimately intermixed with the algaoid cells, and generally in situations to which they could not be supposed to have the power of penetrating.

5. The diatoms can often be seen to have replaced algaoid cells rather than to have pushed them aside.

6. Finally, in places, the algaoid cells can be seen elongating into the forms of the diatoms and at the same time changing from a bright green to a yellowish-brown colour.

Moreover, since making these observations on *L. gibba* and *L. minor* I have ascertained that similar transformations of some of the fission-products of the *Chlorochytrium* which infests *L. trisulca* are also to be met with in that species of duckweed. The diatoms found in this species have been almost always very small and of the *Navicula* type—no *Nitzschia* having ever been seen in association with the segmentation-products of this particular variety of *Chlorochytrium*, although the duckweed bearing it has been taken from one of the same ponds from which I have obtained my supplies of *L. gibba* and *L. minor*. In fig. 6 ( $\times 375$ ) some of the combinations that have been met with are shown. In A four small spaces are shown: in the upper one algaoid segments and diatoms were intermixed; in the one on the left young diatoms were seen forming, the contents of this space being distinctly paler than those of the other two spaces, in which the diatoms were more fully formed and more closely packed. In B two or three fused contiguous spaces are shown in which algaoid cells and diatoms, together with various intermediate forms, were intimately intermixed; while C is the only space that I have yet found in *L. trisulca* containing diatoms as large as are there represented. They were mixed with *Chlorochytrium* cells and other minute diatoms, though the latter are not recognizable in the photograph.

It is worthy of note that in *Lemna trisulca* there are no stomata. The active algaoid spores penetrate, as F. Cohn showed, by boring between the epithelial cells into subjacent spaces, where they increase and multiply in practically closed cavities and become also surrounded by a kind of capsule. Subsequently their active spores make their way out through



very minute apertures which they themselves form; but in this species of duckweed there are no widely dilated stomata through which in earlier or in later stages, should they attempt it, diatoms would be free to enter.

Another point is also of much importance, and that is the frequency with which diatoms may be seen around the periphery of spaces still densely crowded with *Chlorochytrium*-products which have not yet begun to emerge. These diatoms therefore make their appearance within closed cavities and often in regions far removed from the original point of entry of the active algoid spore. No infection hypothesis, even backed by a further hypothesis of chemotaxis, is, I submit, capable of explaining the presence of these diatoms. They are evidently formed where they are found by a transformation of the algoid cells, and different stages of the process may often be clearly recognized, the spherical cells, as I have said, becoming elongated and changing from a bright green to a brownish-yellow colour as they take on the forms of the diatoms\*.

#### EXPLANATION OF PLATE XV.

All the components of figs. 1-3 have been photographed at a magnification of 250 diameters except fig. 2, B; this, as well as all the components of figs. 4, 5, 6, have been taken at a magnification of 375 diameters.

*Fig. 1.* A, shows two stomata of *Lemna gibba* which have been penetrated by spores of *Chlorochytrium Knyanum*; in the lower one the spore has divided. B, a group of *Chlorochytrium* cells within a substomatal space. C, another group (older) in which the cells are more closely pressed together. D, a still older patch of *Chlorochytrium* that has begun to yield spores, some of which have passed out and are lodged between the spherical cells situated underneath the epidermis.

*Fig. 2.* A, several contiguous patches of *Chlorochytrium*, showing fission-products varying much in size. B, a single large *Chlorochytrium* cell which is full of spores. C, a partially empty sub-stomatal space containing fission-products of medium size. D, a similar partly empty space containing diatoms of medium size. The wall of the space was distinctly more brown in D than in C.

*Fig. 3.* A, a mixture of fission-products and of diatoms of different sizes within a space. B, another space containing rather larger fission-products mixed with rather large diatoms. C, like the last, only with a much larger number of diatoms than of fission-products. D, a space containing larger diatoms still, together with some very minute ones in an upper extension of the space.

The diatoms shown in this figure are probably different kinds of *Naviculæ*.

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\* In my 'Studies in Heterogenesis,' Part iii. Sec. xiii. p. 181, I have described and illustrated the origin of diatoms from other algoid cells which are often to be found on the surface and in the substomatal spaces of the different species of duckweed.

Fig. 4. A and B, two spaces containing a mixture of small *Chlorochytrium* segments and of developing diatoms. C and D, two other spaces with very few green fission-products, but with many much elongated diatoms of the *Nitzschia* type.

Fig. 5. A, an epidermal cell full of *Chlorochytrium*. B, two other cells containing *Chlorochytrium* which seems about to divide into fission-products. C, another epidermal cell containing *Chlorochytrium* which has divided into several nearly equal segments. D, an epidermal cell containing many small segments which had assumed a yellowish colour and were beginning to elongate. E, an epidermal cell containing diatoms mixed with some green fission-products. F, another epidermal cell containing a number of diatoms, but only two green *Chlorochytrium* fission-products. All these diatoms resembled small *Naviculae*.

Fig. 6 shows diatoms developing from the fission-products of *Chlorochytrium Lemnæ*. A, four contiguous spaces, of which the upper one contained a mixture of minute fission-products and of diatoms, that on the left diatoms in an early stage of development, while the other two were densely packed with more mature *Naviculae*. B, two large contiguous spaces containing an intimate mixture of fission-products and of developing diatoms. C, another space containing some fission-products and a number of diatoms larger than are usually to be found within the sub-epidermal spaces of the ivy-leaf duckweed.

### IX.—Descriptions of Three new Batrachians from Tonkin.

By G. A. BOULENGER, F.R.S.

A COLLECTION made by Mr. H. Fruhstorfer, of Berlin, in the Man-Son Mountains, Tonkin, altitude 3000–4000 feet, and purchased from him by the Trustees of the British Museum, contains, in addition to several little-known frogs (*Leptobrachium carinense*, Blgr., *L. pelodytoides*, Blgr., *Hyla simplex*, Bttgr., *Rana Guentheri*, Blgr., *R. graminea*, Blgr., *R. nigrovittata*, Blyth, *R. Ricketti*, Blgr., *Oxyglossus Martensii*, Peters, *Rhacophorus verrucosus*, Blgr.), examples of three new species, one of which is even entitled to be regarded as the type of a new genus.

#### OPHRYOPHRYNE, gen. nov.

Pupil horizontal. Mouth small, toothless, inferior. Tongue pear-shaped, adherent, entire, swollen and cup-shaped behind. Tympanum distinct. Fingers free, toes nearly free, the tips not dilated. Outer metatarsals united. Omosternum cartilaginous; sternum with a slender bony style. Sacral vertebra with very strongly dilated diapophyses and one condyle for articulation with the coccyx.

Like *Cophophryne*, Blgr., this genus presents an interesting

combination of characters, agreeing with the Bufonidæ in the absence of teeth, whilst in other respects it shows such remarkable points in common with Pelobatidæ, e. g. *Leptobrachium* and *Megalophrys*, that one must regard it as on the whole nearer to the latter than to the true toads: another instance of the over-estimation of dentition as a character by which to define families in the Batrachia.

*Ophryophryne microstoma.*

Head small; snout very short, obliquely truncate, projecting considerably beyond the mouth; canthus rostralis distinct, loreal region vertical; interorbital space as broad as the upper eyelid; a horn-like dermal appendage on the superciliary edge; eye rather small, a little larger than the very distinct tympanum. Limbs slender; fingers and toes with slightly swollen tips, without subarticular tubercles; first finger not extending quite as far as second; palmar and plantar tubercles indistinct. The tibio-tarsal articulation reaches the shoulder or the tympanum. Skin with small warts; above with delicate symmetrical glandular lines, which form two V's on the head and anterior part of the back and an H on the posterior part. Greyish, with darker symmetrical markings; black spots on the sides of the body and limbs; a white wart on each side of the breast.

Four specimens, the largest (a gravid female) measuring 55 millim. from snout to vent.

*Rana nasica.*

Vomerine teeth in two short oblique series between the choanæ. Head a little longer than broad, strongly depressed, with pointed, very prominent snout; canthus rostralis sharp, loreal region deeply concave; nostril equally distant from the eye and the tip of the snout; interorbital space nearly as broad as the upper eyelid; tympanum very distinct,  $\frac{2}{3}$  to  $\frac{3}{4}$  diameter of eye. Fingers rather slender, first extending beyond second; toes entirely webbed; tips of fingers and toes dilated into well-developed disks; subarticular tubercles small but very prominent; a small oval inner and a very small round outer metatarsal tubercle. Tibio-tarsal articulation reaching the tip of the snout or a little beyond. Skin smooth, granulate on the pelvic region; a narrow glandular dorso-lateral fold. Greyish olive or brown above, with or without blackish spots; canthus rostralis, temple, and outer edge of glandular lateral fold blackish; upper lip from below

the nostril white; tympanum reddish; limbs with numerous regular dark cross-bars; lower parts white, uniform or dotted with brown. Male without humeral gland, with a large external vocal sac on each side of the throat.

From snout to vent 46 millim.

Four male specimens.

Closely allied to *R. alticola*, Blgr., which differs in the less prominent snout and the less deeply concave loreal region.

*Rhacophorus corticalis.*

Vomerine teeth in two small oblique groups between the choanæ. Head large, very strongly depressed; snout rounded, with prominent canthus, and very oblique slightly concave loreal region; interorbital space as broad as the upper eyelid; tympanum as large as the eye. Fingers free, ending in very large disks; toes entirely webbed, the disks smaller than those of the fingers. Tibio-tarsal articulation reaching the anterior border of the eye. Skin above very rough with large irregular warts studded with small granules; lower parts granular; large conical tubercles on the back of the thighs near the vent. Dark olive above, marbled with blackish; sides and lower parts yellow, spotted or marbled with black; limbs with dark bars, extending across the lower surface of the leg. Male without vocal sac.

From snout to vent 70 millim.

Two specimens, male and female.

Very closely allied to *R. leprosus*, Schleg.; distinguished by a still more depressed head, a larger tympanum, and the presence of conical warts on the back of the thighs.

X.—*On Two new Muridæ from Smyrna.*

By OLDFIELD THOMAS.

THE British Museum is indebted to Mr. W. Griffith Blackler for examples of a mouse and a gerbille from Smyrna which appear to represent new forms of their respective genera.

*Mus mystacinus smyrnensis*, subsp. n.

Similar to the typical *M. mystacinus*, Danf. & Alst.\*, and to the very closely allied *M. epimelas*, Nehr.†, but with a pure white belly.

\* P. Z. S. 1877, p. 279.

† SB. Ges. nat. Fr. Berl. 1902, p. 2.



General colour above rather paler and less blackened than in *mystacinus* and *epimelas*, which in this respect are precisely similar to one another. Head and fore-back greyer than the buffy or drab hind-back. Sides clearer drab. Under surface from chin to anus pure snowy white, sharply defined laterally, the hairs white throughout except a few on the chest, which have their extreme bases slaty. Ears large, thinly haired, greyish. Outer side of forearms and of legs drab, similar to the sides, not markedly greyer as in the allied forms. Hands and feet pure white. Tail well-haired, sharply bicolor, blackish above, pure white below.

Skull closely similar to that of *mystacinus*, but the palatal foramina rather longer, reaching to the level of the front of  $m^1$ , and the interpterygoid fossæ (instead of being parallel-sided) narrowed at their centre by the bowing-in of the pterygoids, as is also the case in *epimelas*.

Dimensions of the type (measured in the flesh by Mr. Blackler):—

Head and body 116 millim.; tail 136; hind foot (s. u.) 25; ear 20.

Skull: greatest length 31·3; basilar length 24·4; length of nasals 12·2; interorbital breadth 4·7; palate length 13·7; diastema 8·3; palatal foramina  $7·1 \times 2·4$ ; length of upper molar series 4·8.

Type. Old male. B.M. no. 3. 6. 1. 3. Original number 9. Collected 25th February, 1903.

“Caught in a cave, at an altitude of about 300 feet.”

Dr. Nehring distinguished the Grecian *Mus epimelas* from *M. mystacinus* on certain discrepancies which his type showed as compared with Danford and Alston's description of the Asia Minor species. But, as a matter of fact, these discrepancies all disappear on the examination of a number of specimens, and our excellent series of “*epimelas*” from Montenegro and Albania contains examples agreeing exactly with the cotypes of *mystacinus* in all the characters mentioned by Dr. Nehring. But the European form seems always to have rather larger molars than the Asiatic one, and as *smyrnenensis* occurs between the two, the former might, I think, be best regarded as a subspecies of *mystacinus*. The new subspecies is readily distinguishable from both by its pure white belly.

*Meriones Blackleri*, sp. n.

A fairly large species with small bullæ and white-tufted tail.

General colour pale greyish fawn, paler and more greyish

than in most members of the group; anterior back approximately "drab-grey" of Ridgway, posterior back more fawn-coloured. Sides lighter grey, edged below with an indistinct buffy line. Whole of under surface pure white to the roots of the hairs. Centre of face fawn-grey; cheeks greyer and a marked clear grey patch present between eye and ear. Ears rather large, the fine hairs of their outer surface fawn anteriorly, brown posteriorly, but the hinder margin both outside and in is edged with white. A marked white postauricular patch present. Outer side of forearms and lower leg buffy, hands pure white; feet white, mixed proximally with buffy. Tail dull buffy for its basal two thirds, then on its subterminal sixth the crest-hairs above are tipped with black, while the long-haired terminal sixth is abruptly pure white all round. In a younger specimen the white tip, though present, is much shorter.

Skull rather delicately built for its size. Teeth small and narrow. Bullæ unusually small for this group.

Dimensions of the type (measured in the flesh by Mr. Blackler):—

Head and body 137 millim.; tail 151; hind foot (s. u.) 33; ear 18.

Skull: greatest length 38·7; basilar length 30·5; zygomatic breadth 21; length of nasals 16; interorbital breadth 5·9; diastema 11; bullæ 12×8; length of upper molar series 5·2.

*Type.* Adult male. B.M. no. 3. 6. 1. 1. Original number 5. Collected 5th January, 1903, and presented by Mr. W. G. Blackler.

"In an open field. Alt. 400 feet."

This fine gerbille is readily distinguishable from any of its allies by its pale greyish colour and white-tipped tail.

#### BIBLIOGRAPHICAL NOTICE.

*The Fauna of British India, including Ceylon and Burma.* Published under the Authority of the Secretary of State for India in Council. Edited by W. T. BLANFORD.—*Hymenoptera.* Vol. II. *Ants and Cuckoo-Wasps.* By Lieut.-Colonel C. T. BINGHAM. London, 1903. 8vo. Pp. xix, 506. 1 coloured plate; xiii. & 161 figures in the text.

It is less than a year since the first volume of Mr. Distant's monograph on the Indian Rhynchota in the present series of works

came under our notice for review, and we have now the pleasure of welcoming the second volume of Col. Bingham's work on the Hymenoptera Aculeata of India, comprising the important families of Formicidæ and Chrysididæ, and thus completing the best-known and most interesting, though not the most numerous, section of the order—the Aculeata, or Stinging Hymenoptera: the Bees, Wasps, and Ants.

We are very pleased to see that the claims of entomology are so fully recognized by those who are responsible for the issue of this valuable series of publications. A volume by Mr. Gahan on Longicorn Coleoptera and a second volume by Mr. Distant on Rhynchota are announced as nearly ready for press, and works on the Land-Mollusca and on the Butterflies of India (the latter by Col. Bingham) are likewise in preparation. It is much to be wished that the colonies in general would follow the good example set them by India, and undertake the preparation of a similar series of works dealing with their own natural productions. For instance, we have not even a comprehensive work on the Butterflies and Moths of the British West Indies, though these insects are admired by every one, and the West Indian species are fairly well known to specialists. Nevertheless the amateur or the beginner would find nothing like a comprehensive account of even the Lepidoptera of Jamaica in any accessible form; and less still on other orders of insects. This should not be.

It will be seen that such a reproach no longer exists in regard to India, for we may reasonably hope that all the orders of insects will ultimately be treated as fully as those already in course of publication. But even as regards the British Islands we have no sufficiently comprehensive scientific or popular works at present on the Diptera and a portion of the Hymenoptera, though Mr. Verrall has commenced a series of volumes on the former order and Mr. Claud Morley has promised us a volume on the Ichneumonidæ.

To those who are acquainted with Col. Bingham's previous work it will only be necessary to say that the volume before us is executed in his usual careful manner and according to the plan which has been uniformly followed in all the volumes of 'The Fauna of British India.' He has described 577 species in the volume before us, 498 Formicidæ and 79 Chrysididæ. Among these are a few new species. The number of British species known in 1871-2, according to the catalogues of Smith and Marshall, and not greatly increased since, stood at 31 Myrmicidæ and 22 Chrysididæ. This will serve to illustrate the difference between a temperate and a tropical fauna.

## PROCEEDINGS OF LEARNED SOCIETIES.

## GEOLOGICAL SOCIETY.

March 25th, 1903.—Prof. Charles Lapworth, LL.D., F.R.S.,  
President, in the Chair.

The following communications were read:—

1. ‘On a New Species of *Solenopsis* from the Pendleside Series of Hodder Place, Stonyhurst (Lancashire).’ By Wheelton Hind, M.D., F.R.C.S., F.G.S.

This specimen of a perfect left valve was found by the Rev. Charles Hildreth, in shales belonging to the Pendleside Series, which have yielded the following fossils:—*Phillipsia Vander Grachtii*, *Ph. Polleni*, *Prolecanites compressus*, *Glyptoceras spirale*, *Gl. reticulatum*, *Gl. platylobium*, *Orthoceras annulosolineatum*, *Posidonomya Becheri*, *Solenopsis major*, and a few brachiopods.

2. ‘Note on some *Dictyonema*-like Organisms from the Pendleside Series of Pendle Hill and Poolvash.’ By Wheelton Hind, M.D., F.R.C.S., F.G.S.

Mr. D. Tate discovered a specimen, in the shales and limestones in the Angram Brook, which had some resemblance to a *Dictyonema*; and he afterwards found another similar specimen, on or about the same horizon, at Poolvash. These are referred to distinct species, and doubtfully assigned to the genus *Dictyonema*. A piece of shale from the Bishopton Beds in Glamorganshire has somewhat similar, but less distinctly reticulate markings.

May 13th, 1903.—Edwin Tulley Newton, Esq., F.R.S.,  
Vice-President, in the Chair.

The following communication was read:—

‘Description of a Species of *Heterastræa* from the Lower Rhætic of Gloucestershire.’ By Robert F. Tomes, Esq., F.G.S.

The specimen described was obtained by Mr. L. Richardson from Lower Rhætic Beds at Deerhurst (Gloucestershire). It occurred a little way above the bone-bed; it is specifically new and generically new to the Rhætic, and it displays Jurassic relationships. It differs from the several Liassic species in the small size of the corallum and of its calices. Remarks on some other Madreporaria from the Rhætic and from the basement of the Lower Lias are appended. It has always been the Author’s opinion that the Sutton Stone containing Rhætic Madreporaria should be classed as Rhætic; indeed he believes that it is really Upper Rhætic; and in view of the very close affinity of its organisms with those of the Lower Jurassic, and bearing in mind the great importance of the ammonite-zones as a means of classification of the Liassic deposits, he asks whether the zone of *Ammonites planorbis* should not be taken as the bottom of the Lias.



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## MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 68. AUGUST 1903.

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XI.—*Descriptions of new Eastern Moths.*  
By Colonel C. SWINHOE, M.A., F.L.S., &c.

### Family Deilemeridæ.

*Deilemera sangira*, nom. nov.

*Deilemera distincta*, Swinh. Trans. Ent. Soc. 1903, p. 58, pl. iv. fig. 4.

Sangir.

I find this name must be changed, because Walker had already used it for a species of this genus in 1854, Cat. vol. ii. p. 392.

### Family Arctiidæ.

*Pericallia accensa*, nov.

♀. Palpi crimson, last joint black; frons and top of head white, frons with black hairs on each side; thorax and fore wings crimson-ochreous, a crimson stripe on thorax in front: fore wings with a black basal spot on costa, a larger one before the middle, with a minute dot below it; a long costal spot beyond the middle, with a round one below it; a large spot on hinder margin before the middle, with another obliquely above it; a macular oblique band from vein 5 to hinder margin beyond the middle, the spots nearly square and increasing in size hindwards; a short subapical black streak:

*Ann. & Mag. N. Hist. Ser. 7. Vol. xii.*

hind wings crimson, with a large black spot at end of cell: abdomen crimson, with a medial row of small black spots. Underside: both wings paler crimson, with most of the spots as above; body white; legs black, streaked with crimson; abdomen with a double row of black spots on each side.

Expanse of wings  $2\frac{7}{10}$  inches.

Dili, Sumatra (*Fruhstorfer*).

### Family Lymantriidæ.

#### *Orygia nigriplaga*, nov.

♂. Antennæ grey, shafts ochreous; palpi, head, thorax, and fore wings olive-ochreous or chestnut-ochreous, varying much in shade of colour, and generally becoming paler towards apex; a blackish-brown patch in the upper disk, varying much in size in different examples, but always connected by a thin band to a smaller patch on the hinder margin beyond the middle: hind wings uniform blackish brown. Underside blackish brown, with ochreous costal, apical, and outer borders; abdomen brown above and below; thorax below and legs brown.

Expanse of wings 1 inch.

N. Borneo, five examples (*Fruhstorfer*).

Allied to *nigrocrocea*, Walker; there is an example in the B. M. unnamed from Perissiu, Borneo, in Lymantrid drawer no. 32.

#### *Rajacoa antra*, nov.

♂. Sordid white; wings semihyaline; costal border of fore wings pinkish grey, the grey broadening at the apex and runs down the outer margin, narrowing hindwards: hind wings with outer margin narrowly grey; a very slight pinkish-yellow tinge on the wings: antennæ grey, shafts white; body white above, yellowish beneath; frons white; legs very pale yellowish, nearly white.

Expanse of wings  $1\frac{7}{10}$  inch.

Humboldt Bay (*Doherty*).

Allied to *Forbesi*, Druce, but that species is larger, has no border, and the wings are yellow at the base.

#### *Euproctis anna*, nov.

♂ ♀. Pale yellow, frons partly white; palpi black at the sides: fore wings covered with minute brown irrorations; indications of two pale transverse lines before and beyond the middle, rather close together, both curving towards each

other, and bending apart again on to the hinder margin: hind wings suffused with black; cilia yellow. Underside pale uniform dull yellowish, without markings.

Expanse of wings, ♂  $1\frac{6}{10}$ , ♀ 2 inches.

Kina Balu.

*Euproctis gentia*, nov.

♀. Palpi, antennæ, head, and fore part of the thorax bright orange-ochreous, rest of thorax and abdomen blackish brown, anal tip with some ochreous hairs: fore wings dull yellow, some blackish suffusion on the basal third; a large blackish spot in the middle of the disk and another near the hinder angle: hind wings dull black, outer margin broadly yellow. Underside: legs yellow; body brown; wings dull pale yellowish; fore wings with the inner portions and hind wings with the basal third suffused with blackish.

Expanse of wings  $1\frac{4}{10}$  inch.

Kina Balu.

*Euproctis sexmacula*, nov.

♀. Palpi, head, and fore part of thorax bright orange-ochreous, rest of thorax, abdomen, basal third of fore wings, and basal half of hind wings black, remainder of both wings uniform bright orange-ochreous: fore wings with three unusually large black spots in a sort of triangle—one at the end of the cell, another in a straight line beyond it near the outer margin, and the third near the hinder angle; two black dots accompany the second spot—one above it and the other on its inner side. Underside: body black; legs sordid yellow; wings as above, but on the fore wings there is only one very large black spot at the end of the cell.

Expanse of wings  $1\frac{1}{2}$  inch.

Kina Balu.

*Euproctis civitta*, nov.

♂. Palpi brown; frons, antennæ, and collar ochreous; thorax and fore wings chocolate-brown; the ground-colour really is a kind of ochreous-white, but the entire wing is so thickly irrorated with chocolate-brown atoms as to give it an appearance of that colour; two transverse pale lines, both elbowed outwardly in the middle, the colour between darker than the rest of the wing, forming a broad median brown band; some pale spots on the outer margin and yellowish cilia: hind wings blackish, outer margin broadly pale yellowish: abdomen black, anal tuft bright ochreous. Under-

side whitish; hind wings with the abdominal portion suffused with blackish.

Expanse of wings  $1\frac{2}{10}$  inch.

Kuching, Borneo.

*Euproctis recraba*, nov.

♂ ♀. Palpi ochreous, brown on the upperside; frons ochreous; antennæ, thorax, and fore wings pale chocolate-brown: fore wings with two pale transverse sinuous lines—ante- and postmedial—both single in the male, but in the female the former is single and bent inwards on the hinder margin, the latter double; a brown spot, very indistinct, at end of cell, in the male; a very prominent small black spot in the female; the male has some white patches on the outer margin; the female has the marginal space rather broadly whitish, with the chocolate-brown colour elbowed into it in two or three places: hind wings white, a little chocolate-grey suffusion towards the abdominal margin: abdomen black, anal tuft ochreous. Underside: body, legs, and wings whitish, without markings.

Expanse of wings, ♂  $1\frac{6}{10}$ , ♀  $1\frac{8}{10}$  inch.

Java.

The female much resembles *E. atripuncta*, Hmps., from the Khasia Hills, but both lines in that species are double and terminate close together on the hinder margin, and the male is differently shaped and has a prominent black small spot at the end of the cell.

*Euproctis renifera*.

*Euproctis renifera*, Swinh. Trans. Ent. Soc. 1895, p. 12.

Khasia Hills.

The type from Cherra Punji now in the B. M. is a female. I have lately received five males from the same locality, and as there is much difference between the two sexes, the following description will be useful:—

♂. Ochreous brown; palpi with some blackish-brown hairs; antennæ blackish, shafts whitish: fore wings with the outer portions pale and suffused with ochreous; an ante-medial, nearly straight, double brown line, with the inner space ochreous; this line is outwardly oblique from one third hinder margin to middle of costa, crossing a large brown blur, almost effacing a brown spot at the end of the cell; a discal sinuous brown band and some marginal black marks,



including two prominent spots above the middle, as in the female: hind wings blackish brown; cilia of both wings ochreous.

Expanse of wings  $1\frac{8}{10}$  inch.

*Euproctis barbara*, nov.

♂. Antennæ, palpi, head, thorax, and fore wings bright dark ochreous, palpi blackish brown on the upperside: fore wings with a black round spot at the end of the cell and a discal macular blackish-brown thin band, divided by the veins into small squarish spots: hind wings blackish brown, outer marginal area and cilia pale ochreous. Underside pale whitish ochreous; fore wings with a brown spot at the end of the cell; hind wings with the abdominal area blackish brown; abdomen above and below blackish brown, anal tuft ochreous; legs dark ochreous; tarsi whitish.

Expanse of wings  $1\frac{4}{10}$  inch.

Kuching, Borneo.

Allied to *E. zeboe*, Moore, from Java.

*Euproctis magna*.

*Somena magna*, Swinhoe, Trans. Ent. Soc. 1891, p. 479.

The type was a female from the Khasia Hills, one of several received from my collector. I have now received two males, which I think should be described.

♂. Paler than the female, the black irrorations on the fore wings less dense, the yellow marginal band narrower and whiter; besides the pale discal line visible in the female, there is a pale inner line, which is acutely bent outwards above the middle, then downwards with an inward bend, ending on the hinder margin not far from the origin of the discal line; the hind wings, with hardly any brownish suffusion, nearly pure white; abdomen with a golden-brown anal tuft.

Expanse of wings  $1\frac{8}{10}$  inch.

*Dasychira strigata*.

*Dasychira strigata*, Moore, Lep. Atk. p. 58 (1879).

*Dasychira niveosparsa*, Butler, Ill. Het. v. p. 59, pl. xci. fig. 7 (1880).

The types from Simla and Darjiling, both females, are in the B. M.; the male has hitherto been unknown, but I have lately received both sexes from the Khasia Hills and a male from Masuri, six males in all, and therefore describe it.

♂. Palpi black, whitish at tip; frons, head, thorax above

and below, and legs grey: fore wings with the ground-colour grey, with several transverse, brown, very sinuous lines—first subbasal, second antemedial and double, the space between dark; an ear-shaped brown mark at the end of the cell, with a dark diffused band through it, to the middle of the hinder margin; a duplicate recurved discal line; a submarginal lunular line and a marginal line: hind wings orange-ochreous, greyish on outer areas; a discal grey band.

Expanse of wings 2 inches.

I have taken the Masuri example as the type; the Khasia Hill examples are, however, identical.

*Dasychira magnalia*, nov.

♂ ♀. Olive-brown, shining; palpi and frons chestnut-brown; head, thorax, and fore wings dark olive-brown: fore wings with a brown ear-shaped mark on an ochreous ground at the end of the cell; basal, antemedial, and postmedial transverse, blackish-brown, sinuous, and semidentate lines, the first and second erect, the third recurved; a discal, highly sinuous, ochreous line, rather close to the margin; small ochreous marginal lunules: hind wings brown, an indistinct mark at the end of the cell and indications of a discal band. Underside dark brownish grey, tinged with pink; a transverse brown band across the disk of both wings, angled outwardly on the hind wings, which also have a brown spot at the end of the cell; legs black.

Expanse of wings, ♂  $1\frac{6}{10}$ , ♀  $1\frac{7}{10}$  inch.

Khasia Hills.

Is a distinct and good form, allied to nothing I know of.

*Lymantria silca*.

♂ ♀. Antennæ ochreous, shafts whitish; palpi whitish, brown on the upperside; head, thorax, and fore wings very pale ochreous buff, very slightly tinged with pink; some brown marks on the costa, very indistinct; a few brownish dots on the outer margin and a few scattered here and there over the surface of the wings; in some examples there is a brown dot at the end of the cell, in one example it is a fairly sized spot: hind wings white, without markings; both wings very thinly clothed, almost semihyaline. Underside white, without markings; legs slightly tinged with ochreous.

Expanse of wings, ♂  $1\frac{3}{10}$ , ♀  $1\frac{6}{10}$  inch.

Fergusson Island.

There are three males and a female from Fergusson Island and New Guinea in the B. M. unnamed Lymantrid drawer no. 50.

## Family Notodontidæ.

*Pydna postrubra*, nov.

♂. Antennæ ochreous red, shafts whitish; palpi, frons, body beneath, and legs white, palpi deep black on the upper-side; head, thorax, and fore wings above greyish ochreous, the fore wings minutely irrorated with grey atoms, leaving some pale elongated streaks in the disk and lower portions of the wing; a submarginal row of short black streaks, two or three of them duplicated, all caused by clusters of black scales; abdomen and hind wings dull red, ochreous-tinged; cilia of both wings pale yellow. Underside: wings uniformly pale yellowish white, the space on the fore wings below the median vein of a kind of glazed fawn-colour.

Expanse of wings  $2\frac{6}{10}$  inches.

Sumatra, Solok (*Fruhstorfer*).

## Family Geometridæ.

*Obeidia lucifera*.

*Obeidia lucifera*, Swinh. Ann. & Mag. Nat. Hist. (6) xii. p. 153 (1893).

*Obeidia tigridata*, Thierry-Mieg, Ann. Soc. Ent. Belg. xliii. p. 20 (1899).

The types are marked "India" in the O. M. I have it in my own collection from Sikkim and the Khasia Hills; Thierry-Mieg describes it from the same localities; Hampson ('Moths India,' iii. p. 309) has sunk it to the Chinese form *tigrata*, Guen., but it has nothing to do with that species.

*Sterrhia rufula*, nov.

♀. Fore wings pale flesh-colour, with the lines deeper tinted; first basal line nearly straight, second median, outcurved at middle; exterior and submarginal lines bent outwards below middle; all the lines diffuse and ill-defined; costa near base deeper coloured; fringe concolorous: hind wings with three indistinct lines. Underside paler; thorax and abdomen like wings; face and vertex dark brown-red.

Expanse of wings  $1\frac{6}{10}$  inch.

Labuan, Borneo.

## Family Noctuidæ.

*Polydesma prasina*, nov.

♀. Palpi brown, tips of the joints white; head, thorax, and fore wings bright green, variegated in parts with paler green; reniform and orbicular large and whitish, the former round,

the latter oblong ; a large purplish-brown patch on the costa near the base, its outer margin continued in a brown sinuous line to the hinder margin ; a smaller spot at the middle, its inner edge connected with a transversal sinuous line which touches the inner side or the reniform ; a small spot on costa beyond the middle, continued into a discal sinuous transverse line which skirts the outer edge of a large spot in the disk ; this is followed by a similar line and a submarginal line ; the marginal space inside these two last-mentioned lines black, with a green space running through the lower half ; marginal lunules green : hind wings purple-brown, paling towards the base, with some green submarginal spots and indications of a central band ; cilia of both wings brown, with green spots on fore wings and whitish spots on hind wings : abdomen brown, with green dorsal scales. Underside brown ; fore wings with some whitish marks on the costa ; the space below the median vein whitish and indications of two discal bands on both wings, and a lunular mark at the end of the cell of hind wings ; abdomen and legs ochreous grey ; tarsi brown, spotted with white ; fore legs covered with bright green hairs.

Expanse of wings  $1\frac{7}{16}$  inch.

Jaintia Hills, Assam.

Nearest to *virens*, Butler.

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XII.—*New American Hymenoptera, mostly of the Genus*  
*Nomada*. By T. D. A. COCKERELL.

*Ichneumonidæ*.

*Porizon Vierecki*, sp. n.

♂.—Length about 9 millim. ; wings about  $5\frac{1}{2}$  millim.

Head black, with the orbital margins broadly, the mandibles except tips, and a small triangle on each antero-lateral margin of clypeus yellowish white ; eyes purplish ; black area above clypeus strongly punctured, with a central rounded eminence ; scape swollen, pale, tinged with ferruginous ; flagellum long, very dark brown ; antennæ 41-jointed ; thorax black, closely punctured ; mesothorax shining, with subdorsal longitudinal depressions ; tegulæ white ; meta-thorax areolate with raised lines. Wings strongly milky, iridescent, nervures white ; stigma triangular, very dark



brown, its extreme base white; coxæ and trochanters white marked with black. Femora ferruginous, anterior ones with a white stripe; anterior and middle tibiæ pale reddish, with a white stripe; hind tibiæ blackish, with more or less of a white stripe; spurs white, middle tibiæ with two spurs; tarsi whitish, black or nearly so at tips; first abdominal segment black, grooved laterally, its extreme hind margin slightly ferruginous; second segment dorsally black, with its apical margin broadly red; beneath, the segment is yellowish white; remaining segments bright orange-ferruginous.

*Hab.* Arroyo, 10 miles west of La Luz, New Mexico, at light, Aug. 23 (*C. H. T. Townsend*).

I sent some account of this insect to Mr. H. L. Viereck, who was kind enough to look it up in the Cresson collection. He reports it very like *Porizon hyalinipennis*, Cresson, from Texas. It will be known from *P. hyalinipennis* by the paler markings, very milky wings, and clypeus largely black. These insects differ from typical *Porizon* by not having the femora or tibiæ swollen and having the basal joint of hind tarsus slightly longer than the two following ones united. The hind tibia is very much longer than the basal joint of hind tarsi. The eyes are oval, their anterior margins almost parallel.

#### Ceratinidæ.

##### *Ceratina Titusi*, sp. n.

♀.—Length about  $8\frac{1}{2}$  millim. (the type specimen has the head thrust forward, and so appears longer).

Head, thorax, and legs black, the only metallic colour being a slight greenish tint on prothorax, hind border of mesothorax, postscutellum, and metathorax; a longitudinal mark on middle of clypeus, narrow and sharply pointed above, a narrow stripe on anterior orbits up to level of antennæ, its inner edge very irregular, and a stripe behind each eye pale reddish (possibly yellow altered by cyanide); abdomen black, with a hardly perceptible greenish tint; antennæ black, flagellum pruinose. Tegulæ shining very dark brown, with lighter margins. Wings strongly infuscated, nervures and stigma very dark brown; second submarginal cell narrowed above, third very broad above. Head and thorax strongly punctured; mesothorax with the usual smooth space and five impressed lines; basal margin of metathorax shining, with numerous little ridges, but the greater part of the basal area dull and microscopically tessellate; abdomen with the first segment smooth, the second and third strongly punctured,

the others rugose. Pubescence white (except on tarsi behind, where it is orange), quite abundant on hind legs, pleura, and sides of metathorax. Mouth-parts greatly elongated; galea about 6 millim., second joint of labial palpus fully 4 millim., the third and fourth joints extremely minute; maxillary palpi six-jointed, the first joint long, stout, and dark-coloured, the last four short and subequal, these palpi not enlarged; mandibles black, bidentate at apex, produced into a tubercle outwardly near base and into a tooth beneath. Legs ordinary; spurs of hind tibiæ black, one longer than the other.

*Hab.* Bartica, British Guiana, May 21, 1901 (*R. J. Crew*).

Sent by Mr. E. S. G. Titus, and named after him in recognition of his work on bees. Allied to *C. pubescens*, Smith, but differs in the colour of the wings and thorax.

*C. Titusi*, by reason of the greatly produced mouth-parts and the peculiar mandibles, will form the type of a new subgenus, which may be called *Crewella*.

*Ceratina Crewi*, sp. n.

♀.—Length slightly over 7 millim.

Shining dark blue-green (Prussian green), the clypeus with a large, upright, wedge-shaped, cream-coloured mark, but no light colour on orbital margins or cheeks; antennæ short, black, flagellum slightly reddish beneath; head and thorax strongly punctured, mesothorax with the punctures small and close; a rather small, more or less U-shaped, smooth area; extreme base of metathorax longitudinally plicatulate; pleura with short white hair; tegulæ shining very dark brown; wings subhyaline, dusky, nervures dark, stigma narrow, second submarginal cell much contracted above; legs black, the femora more or less bluish, hind femora keeled and subangulate beneath; extreme tips of tarsi ferruginous; abdomen with the first segment smooth except on the apical middle, where it is roughened; second to fourth segments punctured, the punctures smallest and closest on second, largest on fourth; fifth and apical segments rugose.

*Hab.* Bartica, British Guiana, May 21, 1901 (*R. J. Crew*).

Sent by Mr. Titus. Closely related to *C. dupla*, Say, but the scutellum is much more closely punctured in the middle than in that species, and there are other differences in detail.

At Georgetown, British Guiana, March 28, 1901, Mr. Crew took a specimen of *Ceratina bicolorata*, Smith, a species hitherto recorded only from Brazil.

## Nomadidæ.

*Nomada erythrochroa*, sp. n.

♀.—Length about  $8\frac{1}{2}$  millim.

Rather light orange-ferruginous, without black or yellow markings; abdomen rather elongated, subfusiform, very minutely yet distinctly punctured. Distinguished from the allied species by the following combination of characters:—Mandibles simple; third joint of antennæ shorter than fourth, but more than half its length; flagellum wholly ferruginous; mesothorax dull, the punctures as close as is possible; scutellum prominent, conspicuously bilobed. Wings smoky, with the usual light spot; stigma dark ferruginous; nervures piceous; second submarginal cell very broad above; third submarginal cell greatly narrowed above, less than half width of second on marginal nervure. Tegulæ large, ferruginous, punctured. Sides of metathorax with conspicuous white hair.

*Hab.* Pasco, Washington State, May 25, 1896 (*Trevor Kincaid*).

*Nomada Grayi*, sp. n.

♀.—Length about 9 millim.

Similar in form and colour to *N. erythrochroa*, but a little duller, with the front, region of ocelli, sides of prothorax, median stripe on mesothorax, large hourglass-shaped mark on metathorax, very broad band from wings to middle and hind coxæ, all the coxæ behind except at apex, spot at extreme base of first four femora beneath, posterior part of cheeks, and extreme base of first abdominal segment all *black*. The only yellow about the insect is a rather large spot on each side of the second abdominal segment. Mandibles bidentate. Third antennal joint as long as fourth or nearly so; antennæ wholly ferruginous. Wings fairly clear, the apex dusky; stigma dark ferruginous, nervures piceous, second submarginal cell little narrowed above. Cheeks and sides of metathorax with conspicuous white hair. Tegulæ light amber-colour.

*Hab.* Corvallis, Oregon, May 7, 1898.

Received from Mr. H. L. Viereck. Named after Capt. Robert Gray, the explorer.

*Nomada Clarkii*, sp. n.

♀.—Length about  $9\frac{1}{2}$  millim.

Form ordinary, with oval abdomen, which is extremely

finely punctured; rather dark ferruginous, with a curved stripe beneath each antenna, a large patch above antennæ, joining a patch enclosing ocelli, cheeks behind, sides of prothorax, space behind tubercles, area between wings and the four hind coxæ, coxæ behind except at apex, extreme base of first four femora and underside of hind femora, stripe on mesothorax, broad in front, area on each side of scutellum and sutures between scutellum and mesothorax and post-scutellum, median stripe on metathorax, base of first abdominal segment, suffused spots at sides of first three segments near hind margin, and three bands on ventral surface of abdomen, not reaching sides, all *black*. There is no yellow about the insect. Antennæ wholly ferruginous. Mandibles simple. Tegulæ reddish amber. Wings moderately dark, stigma dark ferruginous, nervures piceous, second submarginal cell very broad above. First joint of anterior tarsi with a rounded excavation on the underside near the base, its proximal side produced into a sort of tooth, which is larger than in some allied species.

*Hab.* Corvallis, Oregon, April 6.

Received from Mr. H. L. Viereck. Named after William Clark, the explorer.

*Nomada Fowleri*, sp. n.

♀.—Length about  $8\frac{1}{2}$  millim.

Form ordinary, abdomen long-oval; head and thorax black, quite densely clothed with pale brownish-grey or dirty white hair; facial quadrangle broader than long; narrow anterior margin of clypeus and mandibles dull ferruginous; mandibles simple, rather strongly curved; the only yellow about the insect is a small patch at the extreme lower corners of face, next to the eyes; scape black; flagellum black above, bright ferruginous beneath; third antennal joint long, almost or quite as long as fourth; scutellum neither prominent nor bilobed; tegulæ shining ferruginous, not punctured. Wings dusky, especially on apical margin, the light spot neither conspicuous nor well defined; nervures and stigma piceous; second submarginal cell very broad above, third narrowed almost to a point. Legs ferruginous, the coxæ and trochanters, the anterior femora more or less behind, the middle and hind femora at base in front, and behind except at apex, and a stripe on the outside of the anterior and middle tibiæ *black*; middle and hind tarsi blackish, the tips of the joints red; hair on inner side of basal joint of hind tarsi very pale golden; abdomen dark chestnut-red above and below, basal half of



first segment black, the red intruding into the black as a double notch.

*Hab.* Corvallis, Oregon, April 15, 1897.

Received from Mr. Viereck. Named after Mr. C. Fowler, who has revised the Californian species of *Nomada*.

*Nomada Lewisi*, sp. n.

♀.—Length 8 millim.

Form ordinary; ferruginous, the extreme lower corners of face, a very small spot on each side of first abdominal segment (sometimes absent), a large spot on each side of second and third segments (often with a minute spot adjacent on the inner side), two spots and a band or four spots on fourth segment, and two spots on fifth segment *bright yellow*; patch enclosing ocelli, hindmost part of cheeks, spot on sides of prothorax, stripe on mesothorax, stripe on metathorax, stripe from wings to middle coxæ, middle femora beneath at base, and hind femora and tibiæ behind suffusedly, all *black*. Mandibles simple; hair of face white in the middle, golden at sides; antennæ entirely red, third joint barely shorter than fourth; mesothorax dull and extremely closely punctured; scutellum not noticeably bilobed; tubercles and tegulæ reddish amber. Wings smoky, the pale patch distinct; stigma ferruginous; nervures piceous; second submarginal cell much broader above than third. Hair on inner side of basal joint of hind tarsi mouse-colour; abdomen with minute close inconspicuous punctures, its first joint without any black, its ventral surface without markings.

*Hab.* Corvallis, Oregon, May 7, June 5; three specimens.

Received from Mr. Viereck. Named after Meriwether Lewis, the explorer.

*Nomada oregonica*, sp. n.

♀.—Length 7–8 millim.

Form ordinary; dark ferruginous, a very minute mark at each lower corner of face, a spot on each side of second, third, and fourth abdominal segments (sometimes only on the second, or on the third and fourth and nearly obsolete on the second), two faintly indicated discal spots on the fifth, and two or four small spots on the ventral surface near the end *yellow*; pattern of black markings as in *N. Lewisi*, but there are *three black stripes on the mesothorax*, the outer ones occasionally failing posteriorly, and the base of the first abdominal segment is black; on the underside of the abdomen there are often three

transverse stains, not amounting to distinct black bands; mandibles simple; flagellum entirely ferruginous; third antennal joint not very much shorter than fourth; head transversely oval; mesothorax very densely punctured; tegulæ yellowish ferruginous, well punctured. Wings moderately smoky; stigma very dark ferruginous, nervures piceous. Scutellum not obviously bilobate; abdomen practically impunctate.

Very similar to *N. Sayi*, Rob., of the Eastern States.

♂.—Length about  $6\frac{1}{2}$  millim.

Head and thorax black instead of ferruginous; antennæ long, flagellum black above; narrow anterior margin of clypeus, lower corners of face, and mandibles except tips dull reddish yellow; labrum the same colour, with the middle blackish; tubercles with a reddish spot, but no other marks on thorax, which is quite hairy; abdomen with a black mark on each side of second segment near base; yellow spots on sides of second, third, and fourth segments, and subdorsally on fifth and sixth; apex strongly emarginate; on the ventral surface basally is a large obcordate black patch. The anterior and middle femora and tibiæ have a very distinct black stripe behind, on the hind legs the black is more abundant and more suffused.

*Hab.* Corvallis, Oregon: 5 ♀, May 21 to June 7; 1 ♂, April 27.

Received from Mr. Viereck.

*Nomada ultima*, sp. n.

♀.—Length 8 millim.

Like *N. oregonica*, but the third antennal joint is very much shorter than the fourth and the first abdominal segment above has black only at the sides of basal half, never in the middle. The anterior and middle femora and tibiæ are red, entirely without markings, but the hind femora have a black stripe behind. The ventral surface of the abdomen is red, wholly without transverse blackish stains. Mandibles simple.

*Hab.* Corvallis, Oregon: 6 ♀, May to June 7.

Received from Mr. Viereck.

*Nomada Astori*, sp. n. (vel *ultima*, var.?).

♀.—Length about  $7\frac{1}{2}$  millim.

Red, with black markings; mandibles simple; abdomen without black bands or yellow spots; yellow at lower corners of face; third antennal joint half length of fourth; sides of abdomen inclined to be black-spotted. Antennæ entirely

ferruginous. Superficially similar to *N. oregonica*, but besides the characters just given differs as follows:—Yellow streak on lower anterior orbits longer; sides of thorax with much less black; mesothorax with only one black band; abdomen with only the sides of first segment showing black (this as in *ultima*); dorsal surface of abdomen bright, but not shining coppery red, except in certain lights, when it has a silvery or even purplish lustre (in *oregonica* it is shining and ordinary). The head is transversely oval, as in *N. oregonica*.

The abdomen in *N. ultima* has the same peculiar appearance as that of *N. Astori*; it is possible that the latter is a variety of the former, but in my material *N. ultima* is easily distinguished by the three black bands on mesothorax and the yellow spots of the abdomen.

*Hab.* Corvallis, Oregon: 1 ♀, June; var. *a*, May 20, ♀.

Named after John Jacob Astor. Received from Mr. Viereck.

The specimen taken in May is smaller and has three bands on mesothorax and the first segment of the abdomen black right across at base; the third antennal joint is even shorter than in the type, being less than half the length of fourth. The abdomen is quite without yellow spots. This looks like a distinct species, but I leave it with this mention for the present.

*Nomada corvallisensis*, sp. n.

♀.—Length about 8 millim.

Dark ferruginous, with black markings; no yellow anywhere. Mandibles simple. Resembles *N. Astori*, but certainly a different species, readily distinguished by having no yellow at lower corners of face; having the third antennal joint at least as long as the fourth; the sides of the dark red abdomen without black marks, and the surface of the abdomen very distinctly punctured, which is not at all the case in *Astori*. Maxillary palpi with the fourth joint longest, but the third almost as long; the fifth and sixth very slender, the fifth conspicuously shorter than the fourth and the sixth than the fifth. Face with short white hair; occiput with tawny hair; scape black above apically; front and region of ocelli suffusedly blackened; mesothorax with a single broad median black stripe; scutellum and postscutellum dark red, but metathorax black; tegulæ shining coppery red, with very sparse punctures. Wings fairly clear, the broadly darkened apical margin strongly contrasting; stigma very dark reddish, nervures piceous; second submarginal cell broad above. Legs red, with little black, but the middle femora at base and the

hind femora behind are conspicuously blackened; hair on inner side of basal joint of hind tarsi pale golden; a trilobed black mark at base of first abdominal segment.

*Hab.* Corvallis, Oregon, May 24.

Received from Mr. Viereck.

Mr. Viereck has called my attention to a character of the venation which is useful for separating closely similar species of *Nomada*. Applied to the species above described it gives these results:—

- (1) Transverso-medial nervure joining discoidal nervure some distance from its base \* ..... *N. Clarkii*, *N. Grayi*, *N. oregonica*.
- (2) Transverso-medial nervure joining discoidal nervure very near to or at its base ..... *N. Lewisi*, *N. Astori*, *N. corvallisensis*, *N. ultima*, *N. erythrochroa*, *N. Fowleri*.

*Nomada aquilarum*, sp. n.

♂.—Length hardly 6 millim.

Black, with cream-coloured markings; abdomen broad and quite small. Facial quadrangle square, the orbits parallel; eyes pale grey; anterior half of clypeus, triangular lateral marks short and blunt above, and broad base of mandibles cream-colour; mandibles simple; labrum dark, very densely punctured; antennæ dark brown above, ferruginous beneath; third joint a little longer than fourth, paler and less shining than rest of flagellum; cheeks wholly black; mesothorax extremely densely punctured; the cream-coloured tubercles offer the only light marking on thorax; scutellum hardly bilobed; tegulæ testaceous, with a small cream-coloured spot. Wings irregularly stained with brown; nervures dark; transverso-medial nervure joining discoidal at its base. Legs black, anterior femora and tibiæ in front and anterior tarsi pale ferruginous; middle and hind tibiæ at base, spot near apex of middle tibiæ, and large wedge-shaped mark on apical portion of hind tibiæ cream-colour; hair on inner side of basal joint of hind tarsi very pale golden. Abdomen with shallow punctures; first segment black, second to fourth with a large wedge-shaped cream-coloured mark on each side, fifth and sixth with bands; posterior margins of third and following segments reddish; apical plate not at all

\* This is true also of the following species in the Cresson collection, as reported by Mr. Viereck:—*N. grandis*, *superba*, *Edwardsii*, *affabilis*, *jocularis*, *Morrisoni*, *civilis*, *electa*, *bella*, *lepida*, *vineta*, *vicinatis*, *bisignata*, *maculata*, *perplexa*, *pygmæa*, *melliventris*.



emarginate; apical portion of venter with three light bands, the first two very broadly interrupted in the middle.

The markings of the hind tibiæ and the immaculate metathorax suggest *N. verecunda*, which, however, is a different thing.

*Hab.* South Fork of Eagle Creek, White Mountains, New Mexico, about 8000 feet, at flowers of *Erigeron macranthus*, Aug. 18 (*C. H. T. Townsend*).

*Nomada beulahensis*, sp. n.

♂.—Length 6–8 millim.

Similar to *N. aquilarum*, but larger, and differing from the above description as follows:—Light markings bright lemon-yellow; anterior margin of clypeus only, and that notched in the middle, yellow; lateral marks narrowly pointed above, often produced some distance up orbital margin; a yellow band beneath eyes, not always developed; labrum yellow; scape yellow beneath; third antennal joint obviously shorter than fourth; tubercles black or with a ferruginous spot; scutellum usually with two ferruginous spots; tegulæ shining coppery; wings more uniformly smoky, but only the apex really dark; not only the anterior, but also the middle femora and tibiæ, ferruginous in front; apices of hind femora and tibiæ reddish; no yellow markings on legs; hair on inner side of basal joint of hind tarsi greyish brown; yellow bands on fourth and fifth abdominal segments with a rounded notch sublaterally behind; yellow on venter extending in spots and interrupted bands as far forwards as the second segment; apical plate strongly notched.

Allied to *N. interruptella*, Fowler.

*Hab.* Beulah, New Mexico, 8000 feet, August 1902, 4 ♀ (*Cockerell*); Chicorico Cañon, near Raton, N. M., Aug. 25, 1 ♀ (*Cockerell*).

*Nomada neomexicana*, sp. n. (vel *texana*, subsp.?).

♀.—Length about 8 millim.

Black, with yellow markings and bright ferruginous legs. Almost exactly like *N. texana*, Cresson (a Texas specimen sent by Mr. Fox compared), but differs as follows:—Mesothorax more coarsely sculptured (more like *N. modesta*); tegulæ orange-ferruginous; light markings pale lemon-yellow (considerably lighter than in *N. modesta*); ventral surface of abdomen wholly dark, except for two very short and minute light linear marks. The metathorax is without the yellow spots of *N. modesta*. Mandibles simple; third

joint of antennæ longer than fourth; transverso-medial nervure meeting basal, but a little on the externo-medial side.

♂.—Length about 9 millim., but more slender.

Differs from the male of *N. modesta* (a Colorado specimen sent by Mr. Fox compared) as follows:—Ventral surface of abdomen with no pale bands, but only four very inconspicuous short pale lines, on segments 3 and 4; yellow markings paler; no yellow spots on metathorax; band on second abdominal segment more narrowed in the middle; apical plate only feebly notched; legs red, the only light markings being cream-coloured spots on hind coxæ and hind tibiæ at apex; wings with a more distinct apical cloud.

Perhaps I ought to regard this as a subspecies of *N. texana*, but, though very close, it is readily distinguishable, and no intermediate specimens have been seen.

*Hab.* Deming, New Mexico, at flowers of *Verbesina encelioides*, July 9 (*Cockerell*); Rincon, N. M., at flowers of *Prosopis glandulosa*, July 5 (*Cockerell*). The first-mentioned locality produced the female, the second the male.

It is rather remarkable that in the *N. modesta* series the southern forms differ from the northern by the absence of the spots on the metathorax; thus, on the Pacific coast, the southern *N. formula*, Viereck, is essentially *N. suavis* without the metathoracic spots. I had arrived at this conclusion from a study of *N. formula* and the description of *suavis*; Mr. Viereck has now confirmed it by comparing the actual types.

*Nomada grindeliæ*, sp. n.

♂.—Length about  $6\frac{1}{2}$  millim.

Shining black, entirely without markings, but with short silvery-white hair, dense on face, labrum, pleura, middle and hind tibiæ, and patches at sides of abdomen. Mandibles largely ferruginous, simple, but broad at end. Eyes greyish black; facial quadrangle practically square; flagellum short and stout; third antennal joint longer than fourth; sides of vertex and of mesothorax smooth and shining; tegulæ dark brown. Wings nearly clear, with the apical margin broadly dusky; stigma black; transverso-medial nervure meeting basal; abdomen smooth and shining; apical plate broad and rounded, not in the least notched.

Allied to *N. pilosula*, Cresson, but the front is not narrowed above and the size is smaller.

*Hab.* Lincoln, Nebraska, on *Grindelia* flowers, Sept. 2, 1901 (*J. C. Crawford*).

Received from Mr. Viereck.

*Nomada aztecorum*, sp. n.

♀.—Length 11 millim. or rather more.

Black, with bright yellow markings. Head broad, but facial quadrangle not far from square; anterior half of clypeus, not extending to sides, yellow; yellow lateral face-marks broad below, narrowing upwardly to form a band on orbital margins reaching above level of antennæ as far as two thirds length of scape; no yellow below eyes, on cheeks, on labrum, or mandibles, but the latter have a ferruginous mark; a very small yellowish-red dot at summit of each eye; mandibles simple; labrum densely punctured, with a median smooth band, slightly elevated on the margin; face and front densely punctured; first three joints of antennæ (except the apical half of scape above) and apex of last joint bright red, the rest black, in strong contrast; third antennal joint barely longer than fourth; thorax extremely densely punctured, especially the dull mesothorax; margin of prothorax above, tubercles, spot on pleura, two pear-shaped spots on scutellum, post-scutellum, and two very small spots on metathorax yellow; scutellum not bilobed; tegulæ bright ferruginous, punctured. Wings strongly smoky, especially on apical margin; stigma dark reddish, nervures piceous; third submarginal cell unusually broad above; transverso-medial nervure meeting basal. Legs black and red, the tibiæ and tarsi with light golden pubescence; a spot on middle coxæ and a very broad V on hind coxæ yellow; femora largely black, tibiæ and tarsi red, the hind ones blackened behind; abdomen with a minute hardly noticeable punctuation, appearing rather as a minute roughening; black, with five yellow bands, the first narrowed to a point in the middle, the second narrowed about half; venter black, with two large yellow triangles, touching in the middle line, on second segment.

*Hab.* Amecameca, Mexico, September (*Barrett*).

Sent by Mr. Viereck, who received it from Mr. Titus. A very fine and distinct species.

*Nomada Vierecki*, sp. n.

♀.—Length about 7 millim.

Black and ferruginous, marked with cream-colour; mandibles simple; third antennal joint longer than fourth; transverso-medial nervure entering the end of the externo-medial. This has been erroneously recorded as *N. modesta*, but it differs conspicuously as follows:—Size smaller; light markings cream-colour instead of yellow; no light spots on meta-

thorax; clypeus black or dark reddish; lower corners of face often reddish; lower part of prothorax, a variable amount of pleura, and metathorax except enclosure red; abdomen with a variable amount of red, always including the base of first segment dorsally and basal half of venter; punctures of mesothorax well separated on a shining ground; ventral surface of abdomen with two light bands, on segments 3 and 4; cream-coloured marks on hind coxæ and hind tibiæ at apex, and sometimes at base. Also similar to *N. Heiligbrodtii*, Cresson, but smaller and differing in various details.

♂.—Length 7 millim. Similar to the female, but some yellowish white on scape beneath and at apex of hind femora; face up to level of antennæ, and higher at sides, yellowish white; apical plate deeply notched.

*Hab.* Juarez, Mexico, May 12, 1 ♂ (*Cockerell*): Las Cruces, New Mexico, 2 ♀, May 10, 11; 1 ♂, May 11 (*Townsend*): Mesilla, N. M., July 25, 1897, at flowers of *Aster spinosus*, 1 ♀ (*Cockerell*): Mesilla Park, N. M., May 7, at flowers of *Dithyrea Wislizenii*, 1 ♀, 2 ♂; May, 1 ♂ (*Townsend*); May 9, on foliage of poplar, 1 ♂ (*Cockerell*).

Named after Mr. H. L. Viereck, in recognition of his work on New Mexico bees.

*Nomada crucis*, sp. n. (vel *texana*, subsp.?).

♂.—Length 7 millim.

Black, with bright yellow markings and red legs; quite like *N. Vierecki*, except in the colour of the markings, the coarsely, densely, and confluent sculptured mesothorax, the longer antennæ, and the strongly testaceous hind margins of abdominal segments 2 to 5. The only red about the thorax is on the hind part of the metathorax. Apical plate of abdomen deeply emarginate. Also formerly confused with *N. modesta*, but is smaller and without the metathoracic spots.

*Hab.* Las Cruces, New Mexico, August 11 &c., 4 ♂ (*Townsend*); Deming, N. M., at flowers of *Verbesina encelioides*, July 9 (*Cockerell*).

This may possibly be a variety of *N. neomexicana*, but it is smaller and more compact, with a shorter abdomen, the ventral surface of which has two pale bands. By the latter character it agrees with *N. texana*, to which it is extremely similar; but although the insect is smaller, the mesothoracic punctures are larger (from middle line to margin near tegulæ 11 or 12 in *crucis*, 14 or 15 in *texana*), and not so close on the disk. In *N. crucis* the transverso-medial nervure joins



the end of the externo-medial; in *texana* it exactly meets the basal.

It is proper to state that my interpretation of *texana* depends upon a specimen from the collection at the Philadelphia Academy, which to all appearances is one of the original fourteen from which Cresson described. However, my specimen has the venter of abdomen black, with a red spot on first segment and conspicuous, narrowly interrupted, yellowish-white bands on segments 3 and 4; whereas Cresson says "venter varied with ferruginous, the third segment generally with a yellow spot on each side."

*Nomada sophiarum*, sp. n.

♂.—Length  $8\frac{1}{2}$  millim.

Black, with very pale yellow markings and red legs; more hairy than usual, the pubescence silvery white, dense and appressed on face, and giving the abdomen a pruinose appearance. Facial quadrangle longer than broad, slightly narrowed below; eyes light green; mandibles except tips, labrum, and face up to level of antennæ (except a little black below antennæ) light yellow, the lateral marks ending abruptly at level of antennæ; the usual small spots on margin of clypeus; no yellow behind eyes; mandibles simple, extremely broad at base; scape cylindrical, much swollen, black above, light yellow beneath; third antennal joint conspicuously shorter than fourth; flagellum orange, black or blackish above on joints 3, 4, 5, and 11, joints somewhat crenulated, the apical one (13) pointed; mesothorax with extremely dense large punctures, much covered by hair in front; margin of prothorax above, tubercles, irregularly semilunar mark below, tegulæ, two small spots at anterior corners of scutellum, and two small marks on postscutellum light yellow. Wings unusually clear, the apical margin dusky, and the light spot distinct; stigma ferruginous, nervures fusco-ferruginous; second submarginal cell broad above; transverso-medial nervure meeting basal. Legs light red, hind coxæ and femora black behind except at apex; hair on tarsi pale golden; abdomen rather long, first segment red, with the base black, and a pair of small black marks about the middle subdorsally; remaining segments black, with very broad pale yellow bands, not or hardly narrowed in the middle; punctures of abdomen close and distinct; apical plate red, very feebly notched; venter red, with much black on first, fourth, and fifth segments.

*Hab.* Mesilla Park, New Mexico, April 16, at flowers of *Sophia* (Cockerell).

The *Sophia* was probably *S. andrenarum*, but perhaps *S. halictorum*; the two species had not then been distinguished.

*Nomada lippiae*, sp. n.

♂.—Length about  $8\frac{1}{2}$  millim.

Black, with very pale yellow markings and red legs; only slightly pubescent, the face shining, with well-separated punctures, and quite bare. Facial quadrangle somewhat broader than long; eyes grey; broad base of mandibles, labrum except blackish stain in middle, clypeus except posterior margin, square supraclypeal spot (surrounded by black), lateral face-marks, and minute spot at top of eyes behind light yellow; the lateral face-marks are broad, ending abruptly halfway between level of antennæ and tops of eyes, and nearly divided below by a black stripe running from the clypeus towards the eye; antennæ slender, ferruginous below and black above; scape unusually long and narrow; third antennal joint very much longer than fourth; mesothorax closely punctured, but shining; upper margin of prothorax, tubercles, a minute anterior and a large posterior spot on pleura, two large contiguous spots on scutellum, and band on postscutellum very light yellow; tegulæ light red, with a cream-coloured spot. Wings with lower half almost clear, upper half dusky except at base, very strongly so apically; stigma ferruginous, nervures fuscous; transverso-medial nervure meeting basal, but a little on the externo-medial side. Legs bright red, shining; a spot on hind tibiæ at end and a stripe on basal joint of hind tarsi cream-colour; hair on hind tarsi silvery; abdomen rather long and tapering, shining, but distinctly punctured, brown-black, with very pale yellow bands on segments 1, 2, 4, and 5, that on 4 much narrowed and slightly interrupted in the middle; third segment with a transversely oval spot on each side and a dot mesad of it; apical plate dark brown, rounded, not in the least emarginate; ventral surface very dark brown, with a transverse yellowish band on segment 3, not produced to the sides.

*Hab.* La Cueva, Organ Mts., New Mexico, about 5300 feet, at flowers of *Lippia Wrightii*, Sept. 5 (C. H. T. Townsend).

East Las Vegas, New Mexico, U.S.A.,  
April 15, 1903.

P.S.—Mr. Viereck writes that all the specimens of *Nomada* from Corvallis, Oregon, were collected by Prof. Arthur B. Cordley and his students. Prof. Cordley sent them to Mr. Bradley, who handed them to Mr. Viereck.

XIII.—*On a Collection of Batrachians and Reptiles from the Interior of Cape Colony.* By G. A. BOULENGER, F.R.S.

[Plates XVI. & XVII.]

AMONG the zoological collections made by Messrs. E. C. H. Seimund and C. H. B. Grant at Deelfontein, and presented to the British Museum by Colonel Sloggett, the series of batrachians and reptiles is of considerable interest. Deelfontein, a camp in the Richmond district, 32 miles below De Aar and 25 east of Victoria West, is situated in the middle of a barren region extending for miles in every direction, with nothing but brushwood and thorns, and very little water except immediately after rains. There are, however, a few springs or wells, in which frogs and toads are found. Under such conditions a list of the batrachians and reptiles cannot be expected to be a long one, and it is a surprise to me that two of them should prove to be undescribed.

BATRACHIA.

ECAUDATA.

1. *Xenopus laevis*, Daud.

2. *Bufo Granti*, sp. n. (Pl. XVI.)

Crown without bony ridges; snout short, blunt; inter-orbital space as broad as or a little narrower than the upper eyelid; tympanum very distinct, one half to three fourths the diameter of the eye. Fingers short, blunt, first not extending or extending but little beyond second; toes short, webbed at the base; subarticular tubercles of toes simple, sometimes with a tendency to division; two moderate metatarsal tubercles; a more or less distinct tarsal fold. The hind limb stretched forwards does not extend or extends but little beyond the end of the snout; the tarsal-metatarsal articulation reaches the axil, the shoulder, or between the shoulder and the tympanum. Upper parts with large, more or less prominent, flat warts; parotoids moderately prominent, elliptic or reniform, rather variable in length, parallel or diverging posteriorly; belly granular, at least posteriorly. Greyish or pale olive above, with large brown or dark olive spots or marblings much as in *B. viridis*. Male with an internal subgular vocal sac.

♂. From snout to vent 75 millim. ; hind limb 80.

♀. " " " " 90 " " 85.

Numerous specimens were obtained by Mr. Grant in December on the sides at the bottom of a well at Deelfontein, where they could be seen in the daytime squatting in or near the water ; others were taken on the veldt in March, April, and December, and in camp in November.

In its shorter hind limbs this species differs from *B. regularis* much as our *B. calamita* differs from *B. viridis* ; it also has the inner finger shorter as compared with the second.

3. *Rana angolensis*, Bocage.

4. *Rana Delalandii*, D. & B.

## REPTILIA.

### CHELONIA.

#### 1. *Testudo Seimundi*, sp. n. (Pl. XVII.)

Shell very convex, twice as long as deep, the dorsal shields somewhat swollen and separated from one another by deep furrows ; lateral marginals divided by a very deep groove ; shields strongly striated concentrically ; six vertebral shields, fifth smallest, all except the first much broader than long ; 12 marginals on each side ; nuchal small, longer than broad ; supracaudal single, strongly incurved. Plastron large, flat (male), the gular shields forming a narrow rounded projection in front, the hind lobe deeply notched ; suture between the gulars longer than that between the anals ; suture between the humerals longer than that between the femorals, nearly four times as long as that between the pectorals ; axillary small, inguinal large. Head moderate, with very convex, swollen forehead and strongly hooked beak ; upper head-shields very small, with the exception of three præfrontal shields in a transverse row ; alveolar ridge of upper jaw very feeble. Anterior face of fore limb with very large bony scutes or tubercles as in *T. tentoria* ; a very large bony tubercle on the back of the thigh. Yellowish horn-colour above, with short or interrupted blackish-brown striæ radiating from the centre of each shield ; plastron similar, with mere traces of the dark radiating striæ ; soft parts yellow, head with a few dark brown specks.

Length of shell 98 millim.

A single male specimen was picked up by Mr. Seimund under a Karroo bush in veldt 3 miles east of Deelfontein, about 300 yards from a small rise or kopje.

This new tortoise is to be placed near *T. tentoria*, Bell, from which it differs in the shape of the gular extremity of



the plastron, in the longer suture between the gular shields, in the less convex carapace with deep furrows between the shields, and in the coloration.

2. *Testudo tentoria*, Bell.

3. *Homopus areolatus*, Thunb.

4. *Pelomedusa galeata*, Schoepff.

A remarkably large specimen, the shell measuring 260 millim.

#### LACERTILIA.

5. *Pachydactylus capensis*, Smith.

6. *Agama brachyura*, Blgr.

7. *Agama aculeata*, Merr.

8. *Agama atra*, Daud.

9. *Zonurus polyzonus*, Smith.

10. *Pseudocordylus microlepidotus*, Cuv.

11. *Varanus albigularis*, Daud.

12. *Nucras tessellata*, Smith.

13. *Eremias undata*, Smith.

14. *Eremias pulchella*, Gray.

15. *Mabuia trivittata*, Cuv.

16. *Mabuia varia*, Ptrs.

17. *Mabuia sulcata*, Ptrs.

#### OPHIDIA.

18. *Trimerorhinus rhombeatus*, L.

19. *Psammophis notostictus*, Ptrs.

20. *Aspidelaps lubricus*, L.

#### EXPLANATION OF THE PLATES.

##### PLATE XVI.

*Bufo Granti*, female, natural size, with side view of head.

##### PLATE XVII.

*Testudo Seimundi*, natural size, side view and lower view.

XIV.—*Descriptions of Two new Fishes discovered by Major C. Delmé Radcliffe in the Victoria Nyanza.* By G. A. BOULENGER, F.R.S.

*Barbus Radcliffii.*

Depth of body equal to length of head,  $3\frac{3}{4}$  times in total length. Snout rounded, not projecting beyond the mouth,  $2\frac{2}{5}$  in length of head; diameter of eye  $6\frac{3}{4}$  times in length of head, interorbital width  $2\frac{3}{5}$ ; mouth terminal, its width  $\frac{1}{3}$  length of head; lips much developed, somewhat produced in the middle, the lower continuous across the chin; barbels two on each side, anterior  $\frac{2}{3}$  diameter of eye, posterior as long as eye, the distance between them greater than the diameter of the eye. Dorsal III 9, last simple ray strong, bony, not serrated, straight,  $\frac{1}{2}$  length of head; the edge of the fin slightly emarginate; its distance from the occiput equals its distance from the caudal. Anal III 5, longest ray  $\frac{3}{5}$  length of head. Pectoral acutely pointed,  $\frac{3}{4}$  length of head, not reaching ventral; latter below anterior ray of dorsal. Caudal deeply forked. Caudal peduncle  $1\frac{1}{2}$  as long as deep. Scales finely striated longitudinally, 31–32  $\frac{5\frac{1}{2}}{4\frac{3}{4}}$ , 2 between lateral line and root of ventral, 12 round caudal peduncle.

The skin on which I establish this species, most nearly related to *B. labiatus*, Blgr., measures 560 millim. and is uniform brown, the lower parts and the fins lighter, yellowish.

*Mastacembelus Victorice.*

Depth of body 13 to 14 times in total length, length of head (without rostral appendage)  $7\frac{1}{2}$  to 9 times; vent equally distant from end of snout and base of caudal; length of head 3 to  $3\frac{1}{2}$  times in its distance from vent and  $\frac{1}{3}$  in its distance from first dorsal spine. Snout 4 times as long as eye, ending in a trifid dermal appendage, which is longer than eye; cleft of mouth extending to below nostril; no præorbital or præopercular spines. Vertical fins united with rounded caudal. Dorsal XXXIII–XXXV, circa 100, last spine nearly  $\frac{1}{4}$  length of head. Anal II, circa 100. Scales very small, about 20 between origin of soft dorsal and lateral line. Dark brown above, yellowish beneath, sides with small light spots; head pale brown, spotted or marbled with darker and with a wavy dark lateral band, passing through the eye; a series of large, round, dark brown spots may be present along the lower edge of the caudal region.

Total length 330 millim.

Two specimens are in Major Delmé Radcliffe's collection, and I have examined a third (a young), also from the Victoria Nyanza, forming part of a small series of fishes purchased by the British Museum from Mr. Baxter in 1894. This young specimen had been provisionally referred by Dr. Günther to his *M. shiranus*, which differs in having fewer dorsal spines and soft fin-rays.

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XV.—*On a new Frog from Upper Burma and Siam.*

By G. A. BOULENGER, F.R.S.

TEN years ago, when describing the Batrachians collected in Upper Burma by the late Signor L. Fea\*, I noticed the characters of some frogs from Yado and Thao, Karin Hills, which I took to be males of *Rana Guentheri*, Blgr., a species established upon female specimens from Amoy, China. Having recently had the opportunity of examining a good series of specimens of *Rana Guentheri* from Annam and Tonkin, I have discovered my error in the determination of the male frogs from Yado and Thao, the males of *R. Guentheri* being provided with large external vocal vesicles on the sides of the throat as well as with a humeral gland. The allied frog, in which the vocal sacs are internal, is an undescribed species, and as I have lately had further specimens for examination, collected by Dr. Mortensen on Koh Chang Island, in Siam, for the Copenhagen Museum, I cannot do better than propose for it the name of

*Rana Mortenseni.*

This species is closely related to *R. Guentheri*, but differs in the more posterior position of the vomerine teeth, which form two oblique series or oval groups beginning in the middle between the choanæ and extending posteriorly more or less beyond them, in the shorter snout, in the shorter foot, in the larger terminal expansions of the toes, and in the thicker and more prominent dorso-lateral glandular fold.

In coloration the two species are very similar, but *R. Guentheri* has a more or less distinct whitish posterior border to the tympanum, which does not exist in *R. Mortenseni*.

\* Ann. Mus. Genova, (2) xiii. (1893).

XVI. — *Descriptions of some new Species of Lepidoptera from Tropical South America and one from North Australia.*  
By HERBERT DRUCE, F.L.S. &c.

Fam. Nymphalidæ.

Subfam. ACRÆINÆ.

*Actinote sarsanda*, sp. n.

*Male*.—Head, antennæ, collar, tegulæ, thorax, and abdomen black, the sides of the abdomen slightly yellowish. Primaries and secondaries brownish black, the veins all black, the basal third of the primaries greyish. The underside very similar to the upperside, but considerably paler in colour and the veins more distinct.

Expanse 2 inches.

*Hab.* Ecuador, Chimbo (*Rosenberg, Mus. Druce*).

This species is very distinct from any other known to me.

*Actinote elatus*, sp. n.

*Male*.—Head, antennæ, collar, tegulæ, and thorax black; abdomen reddish yellow, each segment edged with black. Primaries and secondaries deep black; primaries with a large oval-shaped band, partly in the cell and extending nearly to the anal angle; the fringe of both wings black. Underside of the primaries brownish black, the basal half of the wing dull yellow; two yellowish lines near the apex of the wing: secondaries brownish black, yellowish close to the base, the veins black.

Expanse 2 inches.

*Hab.* Ecuador, Paramba (*Rosenberg, Mus. Druce*).

*Actinote chea*, sp. n.

*Male*.—Head, antennæ, collar, thorax, and abdomen black. Primaries black, the basal half red, crossed by the black veins: secondaries black, with a rather wide reddish band from the middle of the cell almost to the outer margin. Underside of the primaries very similar to the upperside, but paler and browner in colour at the apex and along the outer margin: secondaries reddish brown, the veins black; an indistinct submarginal greyish band extends from the apex almost to the anal angle; the interior of the cell pinkish.

Expanse 2 inches.

*Hab.* Interior of Colombia (*Mus. Druce*).



## Subfam. NYMPHALINÆ.

*Callithea lugens*, sp. n.

*Male*.—Head, antennæ, collar, tegulæ, thorax, and abdomen black. Primaries very similar to those of *C. optima*, but much brighter blue, the apical black border much wider; secondaries much brighter blue than in *C. optima*, the blue colour extending right up to the base, as in *C. Whitelyi*; the greenish outer margin is also rather wider. The underside is similar to *C. optima*, but without the black lines and with very much less red at the base of the secondaries, but with much more red than in *C. Leprieurii*; a large round red spot at the end of the cell; the primaries have a submarginal row of five rather large black spots.

Expanse  $2\frac{3}{4}$  inches.

*Hab.* Peru, Cuzco (*Mus. Druce*).

A very distinct species between *C. optima* and *C. Leprieurii*.

## Fam. Papilionidæ.

## Subfam. PAPILIONINÆ.

*Papilio Rosenbergi*, sp. n.

*Male*.—Head, thorax, upper and under sides of the abdomen black, the sides yellow; tegulæ black, with a white spot at the base; antennæ yellow for two thirds from the tip, the remaining part black; legs black. Primaries black, with a streak and a large roundish spot at the end of the cell pale yellow; beyond and below the cell are four elongated yellow spots; three yellow spots near the apex, the first and third elongated, the second oval; a marginal row of small round dots extends from near the apex to the anal angle; the fringe black: secondaries pale yellow, shaded with orange-red in the cell and near the anal angle; the costal and outer margin broadly black; the veins black; a marginal row of small oval yellow spots extends from the apex to the anal angle; the fringe white. Underside of the primaries very similar to the upperside, but much paler; secondaries with the marginal row of yellow spots considerably larger and much paler in colour, and above the row of yellow spots a row of small white dots extending from the apex to the anal angle.

Expanse  $4\frac{1}{2}$  inches.

*Hab.* Ecuador, Paramba, 3500 feet, dry season (*Rosenberg*); eight specimens (*Mus. Druce*).

This species is closely allied to *Papilio ascolias*, Felder, from which it constantly differs in the band of spots being much more elongated and not extending beyond the cell; it is also a smaller insect. I have no doubt it is a distinct southern form or so-called subspecies, the same as *Papilio zalates* is the northern form of *P. ascolias*, both being easily distinguished from the Colombian *P. ascolias*.

### Fam. Arctiidae.

#### *Phragmantobia viridis*, sp. n.

*Male*.—Head, collar, tegulae, and thorax bright pale green; antennae yellowish; palpi bright red; abdomen pale brown. Primaries pea-green, crossed from the costal to the inner margin by two black lines—the first near the base, >-shaped, the second very much curved in the middle; a short black line extends from the costal margin to the end of the cell; the fringe green. Underside pale green, the costal margin edged with red from the base nearly to the anal angle; the black line from the costal margin to the end of the cell the same as above, beyond which is a small black dot; secondaries paler than the primaries, with a faint black spot at the end of the cell and a faint dusky submarginal line; the fringe yellowish green on the underside; close to the costal margin are four black spots.

Expanse  $1\frac{1}{2}$  inch.

*Hab.* S.E. Peru, Santo Domingo (*Mus. Druce*).

This species is allied to *Phragmantobia rubricosta*, Dogn.

### Fam. Liparidae.

#### *Euproctis Meeki*, sp. n.

*Male*.—Head, antennae, thorax, and abdomen chrome-yellow; legs chrome-yellow; anal tuft white. Primaries chrome-yellow, somewhat brownish near the base, the veins yellowish white, in some specimens quite white; the fringe yellow: secondaries paler chrome-yellow, without any markings. The underside of both wings pale yellow.

Expanse  $1\frac{3}{4}$  inch.

*Hab.* N. Australia, Cooktown (*Meek, Mus. Druce*).

This species is also in Mr. Bethune-Baker's collection from British New Guinea.

XVII.—*Report on the Isopoda and Amphipoda collected by Mr. George Murray, F.R.S., during the Cruise of the 'Oceana' in November 1898\*.* By ALFRED O. WALKER.

[Plates XVIII. & XIX.]

*Contents of Tubes.*

ISOPODA.

	No. of Net, &c.	
4 a.	Nov. 20.	1170 fath. }
4 c.	"	920 fath. }
4 f.	"	1275 fath. }
4 h.	"	1470 fath. }
5 h.	Nov. 21.	1410 fath. }
5 l.	"	1710 fath. }

In each of these tubes there was one (in 5 h two) specimen of the Munnopsid described below. In net 4 f there was also an Epicarid larva.

AMPHIPODA.

Lat. 52° 4'·5 N.  
Long. 11° 20'·1 W.

1 a.	Nov. 19.	Surface.	
		<i>Parathemisto obliqua</i> (Kröyer).	5 or 6 young.
1 b.	"	20 fath.	
		<i>Parathemisto obliqua</i> (Kröyer).	♀ and young.
1 c.	"	50 fath.	
		<i>Parathemisto obliqua</i> (Kröyer).	4 young.

Lat. 52° 4'·5 N.  
Long. 12° 27' W.

2 a.	Nov. 19.	270 fath.	
		<i>Brachyscelus</i> sp.	1 young.
2 d.	"	374 fath.	
		<i>Phronima atlantica</i> , Guérin-Mén.	1 young.
2 f.	"	620 fath.	
		<i>Phronima atlantica</i> ?	Too young for identification.
		<i>Scina Rattrayi</i> , Stebbing.	1 young.
2 g.	"	650 fath.	
		<i>Brachyscelus mediterraneus</i> (Claus).	2.

Lat. 52° 27'·6 N.  
Long. 15° 40'·0 W.

4 b.	Nov. 20.	790 fath.	
		<i>Vibilia armata</i> , Bovallius.	1.
4 e.	"	1170 fath.	
		<i>Phronima atlantica</i> .	1.
4 f.	"	1275 fath.	
		<i>Vibilia</i> sp.	Too young.
4 h.	"	1470 fath.	
		<i>Brachyscelus</i> sp.	1 young.

\* See Journ. Geograph. Soc. vol. xiii. no. 2, Feb. 1899, where the method of capture, by open tow-nets in series, is described.

- No. of Net, &c.
- 4j. Nov. 20. 1570 fath.  
*Orchomenopsis abyssorum* (Stebbing). 1.
- 4 k. „ 1670 fath.  
 Epicarid larva. 2.  
*Scina Rattrayi*, Steb. 4.  
*Cyphocaris anonyx*, Boeck. 1 young.
- Lat. 52° 18'1 N.  
 Long. 15° 53'9 W.
- 5 b. Nov. 21. 500 fath.  
*Scina Rattrayi*. 2.  
*Brachyscelus mediterraneus*? Too young.
- 5 c. „ 810 fath.  
 Epicarid larva.
- 5 d. „ 950 fath.  
*Hyperia Latreillei*, M.-Edwards. 1 young.
- 5 e. „ 1070 fath.  
*Scina Rattrayi*. 2.  
*Lanceola* sp. 1 young.
- 5 g. „ 1300 fath.  
*Cyphocaris anonyx*, Boeck.
- 5 h. „ 1410 fath.  
 Epicarid larva. 1.  
*Scina Rattrayi*. 1.  
*Orchomenopsis abyssorum* (Stebbing). 1.
- 5 k. „ 1610 fath.  
*Orchomenopsis abyssorum*. 1.
- 5 l. „ 1710 fath.  
*Phronima sedentaria*. 1.
- 5 s. „ 1510 fath.  
 Epicarid larva. 1.  
*Scina Rattrayi*. 1.

Lat. 52° 20' N.  
 Long. 15° 7'9 W.

- 6 a. Nov. 22. 150 fath.  
*Hyperia longipes*, A. O. W. 1.  
*Brachyscelus* sp.? 1 young. Length 1 millim.
- 6 f. „ 510 fath.  
*Scina marginata* (Bovallius). 1.  
*Scina Rattrayi*. 3.  
*Vibilia armata*, Bovallius. 1.  
*Hyperia longipes*, A. O. W. 1.  
*Cyphocaris anonyx*. 2.
- 6 g. „ 560 fath.  
*Scina Rattrayi*. 2.  
*Lanceola* sp. 1 young.

The following remarks on the distribution of the genera of Amphipoda taken in the tow-nets may not be without interest :—



*Hyperia*, Latreille, 1823, as defined by Bovallius, 1887.

Universal; from the Arctic to the Antarctic seas.

*Parathemisto*, Boeck, 1870.

BOVALLIUS: Arctic and Northern temperate regions (*P. OBLIVIA*); North temperate and subtropical Pacific (*P. japonica*); Antarctic region (*P. Batei*); Pacific, lat. 18° S., long. 124° W. (*P. rubescens*).

STEBBING: Pacific, lat. 35° 20' N., long. 153° 39' E. (*P. pacifica*).

*Phronima*, Latreille.

The distribution of this genus according to Stebbing ('Challenger' Report, pp. 1358-61) is from lat. 60° N. in the Atlantic to lat. 50° 1' S. in the Southern Ocean, and all round the world from east to west.

*Brachyscelus*, Sp. Bate, 1861, = *Thamyris*, Claus, 1878.

STEBBING ('Challenger' Report): N. Pacific, lat. 24° 49' N., long. 138° 34' E. (*B. CRUSCULUM*); N. Pacific, lat. 35° N., between Japan and Honolulu (*B. CRUSCULUM*); Celebes Sea, lat. 6° 20' N., long. 123° 18' E. (*B. inaequipes*); S. Pacific (*B. latipes*); S. Pacific (*B. Bovallii*); Pacific (*B. acuticaudatus*); off St. Vincent, Cape Verde Islands, lat. 16° 49' N., long. 25° 14' W. (*B. MEDITERRANEUS*). All the above were taken on or near the surface. Lat. 58° S., long. 172° W. (*B. antipodes*); Cape of Good Hope (*B. rapax*); Zanzibar (*B. globiceps*); Naples (*B. MEDITERRANEUS*); Atlantic (*B. elegans*).

NORMAN: Faroe Channel, in "towing-net at a depth of several hundred fathoms" (*B. CRUSCULUM*).

*Scina*, Prestandrea, 1833, = *Tyro*, H. Milne-Edwards, 1840.

BOVALLIUS: the Atlantic (*S. cornigera*), and lat. 1° N., long. 18° W. (*S. gracilis*); North, tropical, and South Atlantic (*S. Sarsi*); South Atlantic, Indian Ocean (*S. atlantica*); Pacific, lat. 18° 10' S., long. 126° W. (*S. longipes*); Lofoten Islands, west coast of Norway (*S. borealis*; also G. O. Sars); North Atlantic, lat. 62° N., long. 15° W. (*S. Clausii*); Mediterranean (*S. marginata*); off Cape Horn (*S. Tullbergi*); Corinto, Nicaragua (*S. pacifica*).

STEBBING ('Challenger' Report): South Atlantic, lat. 19° 6' S., long. 35° 40' W., and New Hebrides (*S. cornigera*).

STEBBING (Trans. Zool. Soc. vol. xiii. part x. pp. 349-371, pls. 51-54): Atlantic, 7° 54' N., long. 17° 25' W. (*S. acanthodes*); Atlantic, lat. 7° 1' N., long. 15° 54' W. (*S. stenopus* and *S. cedicarpus*); lat. 1° 55' N., long. 5° 55' E. (*S. RATTRAYI*); lat. 4° 26' S., long. 10° 1' E. (*S. concors*); lat. 3° 0' N., long. 7° 43' W. (*S. similis*); lat. 7° 54' N., long. 17° 25' W. (*S. uncipes*); lat. 5° 88' N., long. 14° 20' W. (*S. cornigera*); lat.

7° 11' N., long. 15° 54' W. (*S. atlantica*); lat. 4° 26' S., long. 10° 18' E. (*S. pacifica*).

The above species are recorded from "near the surface" to a depth of 360 fath. (*S. RATTRAY*).

*Lanceola*, Say, 1818, as defined by Bovallius.

BOVALLIUS: Gulf-stream (*L. pelagica*); North and South Atlantic (*L. Sayana*); Davis Strait (*L. serrata* and *L. Lovéni*); South tropical Atlantic (*L. felina*); Baffin's Bay, lat. 72° N. (*L. Clausi*).

STEBBING: Pacific, lat. 35° 41' N., long. 157° 42' E. (*L. pacifica*); lat. 35° 45' S., long. 18° 31' W. (*L. sp.*); lat. 37° 29' S., long. 83° 7' W. (*L. sp.*); off Banda Island (*L. sp.*); lat. 1° 47' N., long. 24° 26' W. (*L. æstiva*); lat. 42° 8' N., long. 63° 39' W. (*L. Suhmi*); lat. 50° 1' S., long. 123° 4' E. (*L. australis*).

For Mr. Stebbing's interesting remarks on distribution and depth see 'Challenger' Amphipoda, p. 1317. The specimens taken appear to have come from depths ranging from 360 fath. to 2300 fath.

NORMAN (Ann. & Mag. Nat. Hist., Jan. 1900): North Atlantic, lat. 56° 8', long. 13° 34' W. (*L. Sayana*); Faroe Channel, in tow-net sunk 640 fath. (*L. Murrayi*).

*Vibilia*, H. Milne-Edwards, 1830.

BOVALLIUS: Seas of Asia (*V. Peroni*); Atlantic and Mediterranean (*V. Jeangerardi*); Java (*V. affinis*); South Atlantic, lat. 43° 30' S., long. 9° 50' W. (*V. macropis*); lat. 17° 30' S., long. 2° 30' W. (*V. gibbosa*); North Atlantic, tropical Atlantic (*V. robusta*); coast of Scotland (*V. borealis*); west coast of Greenland (*V. Krøyeri*); South Atlantic, Pacific (*V. longipes*); near the Powell Islands (*V. Edwardsi*); North and South Atlantic, Pacific, and Indian Oceans (*V. viatrix*); tropical Pacific (*V. gracilis*); tropical and South Atlantic (*V. ARMATA*); tropical Atlantic (*V. pyripes*).

STEBBING: lat. 25° 30' N., long. 138° E. (*V. propinqua*); South Atlantic (*V. Milnei*); lat. 37° 29' S., long. 27° 31' W. (*V. sp.*); Cape York (*V. viator*); lat. 48° 18' S., long. 130° 4' E. (*V. australis*); lat. 52° 4' S., long. 71° 22' E. (*V. antarctica*); lat. 52° 20' S., long. 72° 14' E. (*V. sp.*).

CHEVREUX: Mediterranean (*V. erratica*) and North Atlantic (*V. Jeangerardi*, *V. hironnellei*, *V. dentata*, and *V. grandicornis*), (Campagnes de 'l'Hirondelle').

BONNIER: Gulf of Gascony (*V. Bovallii*).

All the 'Challenger' specimens of which the depth is recorded were taken on the surface, as also were *V. erratica* and *V. Jeangerardi* by Chevreux.

## GAMMARIDEA.

## Lysianassidæ.

*Cyphocaris*, Boeck and Lütken.

This singular genus has been recorded from the west coast of Greenland (*C. ANONYX*, Boeck) by Hansen, and by Stebbing in the 'Challenger' Report from Tristan d'Acunha, lat.  $32^{\circ} 24'$  S., long.  $13^{\circ} 5' W.$ , off west coast of South America, lat.  $38^{\circ} 7'$  S., long.  $94^{\circ} 4' W.$  (*C. micronyx*), and 400 miles north of the Sandwich Islands (*C. challenger*). As the latter author informs me that he has now merged *C. micronyx* in *C. ANONYX*, this species has a truly enormous range. The 'Challenger' specimens were taken at a depth of 1425 and 1500 fath. respectively. Also taken by the Prince of Monaco in lat.  $47^{\circ} 38' N.$ , long.  $22^{\circ} 13' W.$ , depth 1300 m. (Chevreux, Camp. de 'l'Hirondelle,' 1900, p. 165).

*Orchomenopsis*, G. O. Sars, 1895\*.

This genus was separated by G. O. Sars from *Orchomene* on account of slight differences in structure. It includes two, and perhaps all three, of the 'Challenger' species, and one (*O. robusta*, Sars) from the coast of Norway in 100 fath. The localities of the 'Challenger' species are as follows:—South of Japan, lat.  $26^{\circ} 29' N.$ , long.  $137^{\circ} 57' E.$ , 2425 fath. (*O. musculosus*); east of Buenos Ayres, lat.  $35^{\circ} 39' S.$ , long.  $50^{\circ} 47' W.$ , 1900 fath. (*O. ABYSSORUM*); Kerguelen Island, Betsy Cove, surface, and off Cumberland Bay, 127 fath. (*O. excavatus*). *O. abyssorum* is also recorded by M. Chevreux from lat.  $48^{\circ} 24' N.$ , long.  $20^{\circ} 38' W.$ , depth 2200 m. (Camp. de 'l'Hirondelle,' p. 23).

## LIST OF SPECIES.

## ISOPODA.

## Fam. Munnopsidæ.

## ? Genus MUNNOPSIS, M. Sars, 1860.

*Munnopsis*? *Murrayi*, sp. n. (male). (Pl. XVIII. figs. 1-6.)

Anterior division of the body little wider than and about the same length as the posterior.

\* Since the above was written, the author has met with two new species in a collection made by Mr. Fougner during the 'Southern Cross' expedition to the Antarctic Seas in 1899-1900, and described in a paper read before the Linnean Society on Dec. 18, 1902. These are *O. nodimanus*, Cape Adare, lat.  $71^{\circ} 18' S.$ , long.  $170^{\circ} 9' W.$ , dredged in 26 fath., and *O. Rossi*, from lat.  $78^{\circ} 35' S.$ , long.  $164^{\circ} 32' W.$ , taken near the surface. M. Chevreux also has described (Bull. Soc. Zool. de France, 1903, tome xxviii. pp. 93-96) two new species from the N. Atlantic.

Head having a triangular projection, on which is a tubercle, behind the bases of the upper antennæ; these have the last joint of the peduncle more than twice as long as the penultimate. Lower antennæ wanting in all the specimens. Mandibles with a prominent molar expansion and divided cutting-edge as in *M. longicornis*, Hansen; palp very large and prominent, with a lamellar terminal joint. Maxillipedes with a prominent lobe on the outer margin of the inner plates; palp with the fourth joint large and rounded.

First body (mesosome) segment rather wider than any of the succeeding three; coxal plates rather large, widening distally, so as to conceal the ends of the segments. The first of the last three segments (metasome) with a large oval tubercle on each side of a central cleft; the two following segments widening successively and marked by a transverse division; the last has also a diagonal depression across each hinder angle. All the segments are rugose.

All the ambulatory legs are wanting except the first joints; these in the first pair of legs are twice as long and half as thick as those of the succeeding three pairs. The natatory legs have the fourth joint much expanded posteriorly and more than twice as large as the fifth joint, *which is furnished with a small dactylus*.

Telson cordate, with a blunt carina; margins smooth.

Uropods small and slender, 2-jointed, the second joint three times as long as the first.

As G. O. Sars has pointed out ('Crust. of Norway, Isopoda,' p. 133), *Munnopsis longicornis*, Hansen ('Isopoden &c. der Plankton Expedition,' p. 8, pl. ii. fig. 1), differs in the structure of the mandibles from the generic description, as does the present species. This also differs from both in the structure of the maxillipedes and in the swimming-legs being provided with a dactylus; so that doubtless a new genus is required for its reception. As, however, it is impossible to define a genus satisfactorily from imperfect specimens, M. Sars's genus must stand provisionally. Unfortunately it rarely happens that these Isopods are taken with their long and brittle appendages perfect.

Seven specimens, probably all males. Length 7 millim.

Net 4*a*, 1170 fath.; 4*c*, 920 fath.; 4*f*, 1275 fath.; 4*h*, 1470 fath.; 5*h*, 1410 fath. (2 specimens); 5*l*, 1710 fath.

The only other Isopods in the collection were a few Epicarid larvæ.



## AMPHIPODA.

## Tribe HYPERIDEA.

## Genus HYPERIA, Latreille.

*Hyperia Latreillei*, M.-Edw.

This species is now referred both by G. O. Sars and A. M. Norman to *H. galba* (Mont.).

One young. Length 3 millim. Net 5 d, 950 fath.

## Genus HYPERIOIDES, Chevreux, 1900.

*Hyperioides longipes*, Chev.\* (Pl. XIX. figs. 7-13.)

Head very large, as long as the first five body-segments united, the frontal outline rather concave, the sides produced downwards in two lobes, of which the lower margin is truncate, with rounded angles. The eyes occupy nearly the whole upper part of the head, and consist of dark red transverse bands.

Mesosome shorter and rather narrower than the metasome, all the segments distinct except the first and second, which are dorsally united, the seventh the widest. Metasome deeper than mesosome, the third segment having the hinder angle bluntly rectangular.

Antennæ short and simple, the tips of the lower reaching just below the produced cephalic lobes.

The first and second gnathopods are almost alike, the second being slightly the larger; the first joint is broad and as long as all the remaining joints, the carpus is produced to about the middle of the propodus; dactylus rather long and slender.

The peræopoda are unusually long and slender for this genus; the first and second are about as long as the fifth, the dactyli long, slender, and slightly curved; the third and

\* Since the above description was written, Mons. Chevreux has described the species under the above name in the 'Resultats des Campagnes scientifiques de l'Hirondelle,' fasc. xvi. 1900, p. 143, pl. xvii. fig. 2. The 'Oceana' specimens, however, differ in the form of the telson, which is bluntly triangular. The palp of the first maxillæ is also imperfectly figured, being well developed, with a truncate and spinous terminal margin. The inner plate is armed at the end with strong teeth and setæ, much as in *Hypericella*, Bovallius, as figured by Stebbing under *H. dilatata* (Chall. Amph. pl. clxxi). From this genus it differs only in being more laterally compressed. Chevreux's two specimens were taken in lat. 47° 38' N., long. 22° 14' W., in 1300 fath., and lat. 47° 43' N., long. 19° 30' W., in 781 fath., both in Sept. 1883.

fourth are about the same length and much longer than the fifth; the first joints of all are long and narrow, with parallel margins, those of the third and fourth are as long as the next three joints together and about equal to the fifth joint; all the dactyli rather long.

The peduncles of the third uropods are nearly four times as long as the rami, which are about equal to the telson.

The nearest allies of this species are *H. schizogeneios*, Stebbing, and *H. crucipes*, Bovallius; it differs from both in having only two of the mesosome segments coalesced and in the greater length of the pereopoda, the form of their first joint, &c. It is possible that *Lestrigonus rubescens*, Dana, may be the male of this species.

Two females with ova. Length 4·5 millim.

Net 6 *a*, 150 fath.; 6 *f*, 510 fath.

*Parathemisto oblivia* (Kröyer).

Several young, the largest being 7 millim. long.

Nets 1 *a*, 1 *b*, 1 *c*, surface to 50 fath.

This is a common species in the young state on the west coast of Ireland.

*Phronima sedentaria*, Forskål.

One female. Length 20 millim. Net 5 *l*, 1710 fath.

*Phronima atlantica*, Guérin-Ménéville.

One female. Length 12 millim. Net 4 *e*, 1170 fath.

One young. „ 7 „ „ 2 *f*, 620 „

„ „ „ 5 „ „ 2 *d*, 374 „

The last specimen agrees very nearly with *P. tenella*, Stebbing. All the above, including *P. tenella*, are referred by Chun to *P. sedentaria*. This author (Bibliotheca Zool. vol. vii. 1894-6, Heft xix. p. 110) has the following remarks:—“The young *Phronimas* leave the protecting ‘house’ at the beginning of summer and sink to great depths. They grow to a length of 10 mm., when the females, after obtaining a ‘house’ of *Pyrosoma*, *Salpa*, or *Siphonophora*, rise to the surface in the course of the winter. When sexually mature—in spring in the Mediterranean, but in January at the Canary Islands—the males also rise to the surface and visit the females in their ‘houses,’ reaching the length of 12 mm. and rapidly acquiring their perfect antennæ. They never attain the size of the females, which sometimes measure 40 mm.”

It will be observed that the size of the 'Oceana' specimens increases with the depth, which would seem to indicate that in November the young were still descending. None of the specimens was provided with a "house."

*Brachyscelus mediterraneus* (Claus).

Six young, the largest 8 millim. long, from 650 fath. The type specimen measured  $\frac{3}{4}$  inch.

Net 2 *a*, 270 fath.; 2 *g* (2 specimens), 650 fath.; 4 *h*, 1470 fath.; 5 *b*, 500 fath.; 6 *a*, 150 fath.

This species is considered by Canon A. M. Norman (Ann. & Mag. Nat. Hist. ser. 7, vol. v., Jan. 1900, p. 134) to be identical with *B. cruscolum*, Sp. Bate.

*Scina Rattrayi*, Stebbing.

*Scina Rattrayi*, Stebbing; Trans. Zool. Soc. London, 1895, vol. xiii. p. 358, pl. liii. A.

Several specimens, the largest being 4 millim. long, including the upper antennæ.

The specimen described by Mr. Stebbing (who has kindly verified these for me) was taken "from a depth of 360 fath. after 9 P.M." in lat. 1° 55' N., long. 5° 55' E. Its nearest ally is *S. Tullbergi* (Bovallius), taken off Cape Horn. It may be distinguished from the northern species as follows:—From *S. Sarsi* (Bov.) by the comparative shortness of its upper antennæ, and from *S. Clausii* (Bov.) and *S. borealis* (G. O. Sars) by the second joint of the third peræopods (fifth legs) being serrate on the *hind* margin only.

Nets 2 *f*, 4 *k*, 5 *b*, 5 *e*, 5 *h*, 5 *s*, 6 *f*, 6 *g*, 500–1670 fath.

Also taken by the Prince of Monaco in 1888 in lat. 47° 42' N., long. 19° 30' W. (Chevreux, Amphipodes de 'l'Hiron-delle,' p. 123), depth 781 m.

*Scina marginata* (Bov.).

One young, length including antennæ 3·5 millim.

Distinguished by the few teeth on the *front* margin of the stout second joint of the third peræopods and by the thick, "almost tumid" (Bov.), distal joints and short curved dactyli of the last two pairs.

Previously recorded only from Messina (since the above was written recorded by Chevreux, *l. c.*, from lat. 47° 38' N., long. 22° 13' W., depth 1300 m.).

*Lanceola* sp.

Two specimens too young for identification, viz. :—Net 5 *e*, 1070 fath., 6 millim. ; net 6 *g*, 560 fath., 4 millim.

Most of the species of this genus are very large ; those described by Bovallius range from 10–13 millim. (*L. felina*) to 42 millim. (*L. Sayana*). A species figured in the ‘Challenger’ Report from a drawing by Willemoes-Suhm is supposed to have been 70 millim. in length.

*Vibilia armata*, Bovallius.

Net 4 *b*, 790 fath. 1 specimen, 9 millim.

„ 6 *f*, 510 „ 1 „ 9 „

„ 4 *f*, 1275 „ 1 „ 3·5 „ Too young to be identified.

*V. erratica*, Chevreux, from the Mediterranean, is very near to this species, but has the last two segments of the urosome distinct, while in *V. armata* they are coalesced.

## Tribe GAMMARIDEA.

*Cyphocaris anonyx*, Boeck. (Pl. XVIII. fig. 14.)

(= *C. micronyx*, Stebbing.)

Four specimens, of which one from 1300 fath. appears to be an adult male.

4 *k*, 1670 fath. 1 young.

5 *g*, 1300 fath. 1 adult male, 11 millim.

6 *f*, 510 fath. 2 young, 2½ and 3 millim.

There can, I think, be no doubt that Boeck overlooked the very small dactylos of the second gnathopods, the apparent absence of which gave rise to its specific name. The principal apparent difference between this species and *C. micronyx* is that the distal extremities of the first and second peræopods are somewhat more dilated in the latter.

*Orchomenopsis abyssorum* (Stebbing).

Three specimens, all females.

4 *j*, 1570 fath. 1.

5 *h*, 1410 fath. 1.

5 *k*, 1610 fath. 1.

I have to thank Mr. Stebbing for verifying this species and *Scina Rattrayi*.

Since the above was written, Fascicule xvi. of the Prince of



Monaco's 'Campagnes Scientifiques,' containing the Amphipoda taken by the yacht 'Hirondelle' in 1888, and worked out by Mons. E. Chevreux, has appeared. It is interesting to compare the extract given below, relating to neighbouring parts of the N. Atlantic, with the 'Oceana' results.

Station 253. Sept. 8. Lat.  $47^{\circ} 38' N.$ , long.  $22^{\circ} 13' W.$   
Depth 1300 metres.

*Cyphocaris micronyx*, Steb.; *Scina marginata*, Bov.; *Scina incerta*, sp. n.; *Phronima atlantica*, Guérin; *Hyperia galba* (Mont.); *Hyperioides longipes*, gen. et sp. n.; *Euprimus macropus* (Guérin); *Brachyscelus mediterraneus* (Claus).

St. 256. Sept. 9. Lat.  $48^{\circ} 24' N.$ , long.  $20^{\circ} 38' W.$   
Depth 2200 m.

*Orchomenopsis abyssorum* (Steb.); *Hyperia galba* (Mont.); *Hyperioides longipes*, Chev.; *Brachyscelus mediterraneus* (Claus).

St. 258. Sept. 10. Lat.  $47^{\circ} 42' N.$ , long.  $19^{\circ} 30' W.$   
Depth 781 m.

*Scina Rattrayi*, Steb.; *Phronima atlantica* (Guérin); *Hyperia schizogeneios*, Steb.; *Hyperioides longipes*, Chev.; *Euprimno macropus* (Guérin).

## EXPLANATION OF THE PLATES.

### PLATE XVIII.

- Fig.* 1. *Munnopsis*? *Murrayi*, sp. n. The male seen from above.  
*Fig.* 2. Posterior lip.  
*Fig.* 3. Maxillipedes seen from both sides.  
*Fig.* 4. Pleopod. 4*a*. The end of the fifth joint and dactylus.  
*Fig.* 5. End of the operculum.  
*Fig.* 6. Uropod.  
*Fig.* 14. *Cyphocaris anonyx*, Boeck. End of propodos of second gnathopod, showing the dactylus.

### PLATE XIX.

- Fig.* 7. *Hyperioides longipes*, Chevreux, ♀.  
*Fig.* 8. First gnathopod.  
*Fig.* 9. Second gnathopod.  
*Fig.* 10. Telson and third uropods.  
*Fig.* 11. First maxillæ.  
*Fig.* 12. Ditto, showing palp from another side, the plate folded back.  
*Fig.* 13. Second maxillæ.

XVIII.—*Notes on Neotropical Mammals of the Genera Felis, Hapale, Oryzomys, Akodon, and Utenomys, with Descriptions of new Species.* By OLDFIELD THOMAS.

#### THE SPOTTED TIGER-CATS OF BRAZIL.

AMONG his recent collections Mr. A. Robert has sent home a certain number of small spotted cats, these being animals very badly represented in most Museums, and with their literature and determinations in a great state of confusion.

Of this group Hensel distinguished three species in Rio Grande do Sul, viz. "*Felis macroura*, Wied," "*F. guigna*, Mol.," and a new species he named *F. guttula*. Mr. Robert obtained all these three, and, by the kindness of Dr. Matschie, skulls of his specimens have been directly compared with those of the Hensel collection in Berlin, so that there can be no doubt about their determinations.

At the same time it should be noted that specimens obtained together, and clearly conspecific, show an extraordinary amount of variation both in marking and skull-characters; so that the study of the group is beset with quite unusual difficulties.

The three types referred to may be briefly distinguished as follows:—

- I. Size larger. Fur soft and thick. Nape-hairs generally reversed forwards, at least in part. Skull broadly rounded, with a large smooth brain-case and short face.

To this type belong the Mexican and Central-American tiger-cats, *F. Wiedii*, Schinz (*F. macroura*, Wied), and many others, including *F. glaucula*, sp. n., described below. Cuvier's *F. mitis* would also probably come here, but being without locality is not certainly determinable and should be ignored. The same may be said of Lesson's *F. elegans* \*.

- II. Size rather smaller. Fur harsher. Nape-hairs not reversed. General colour darker. Skull long and narrow, somewhat resembling that of the Jaguarondi, with narrow brain-case and elongated face.

*F. guttula*, Hens.

- III. Size smallest. Fur medium or harsh. Nape-hairs not reversed. Skull small and delicate, with smooth brain-case and short face.

*F. pardinoides*, Gray (*F. guigna*, Mol., of Hensel).

\* Cent. Zool. p. 69, pl. xxi. (1830).

In addition the small-spotted *F. Geoffroyi*, with its little ally *F. salinarum*, sp. n., makes yet a fourth Neotropical section of the group; while a fifth appears to be formed by the true *F. tigrina*\*, judging by a small cat from Cayenne which may be assigned to that species, and is distinguished by its small size, bright colouring, and delicate skull; but it is in too imperfect a state for me to describe it more fully.

*Felis glaucula*, sp. n.

The Mexican representative of Group I. General characters as above described. Colour grey instead of fulvous or tawny.

Size about as in *F. Wiedii*. Fur fine and soft, rather short; hairs of back (April and May specimens) about 17 to 18 millim. Fur of nape reversed forwards, in some cases from behind the withers on to the crown. General ground-colour pale drab-grey, very different to the strong tawny of the South-American members of the group. Linear markings narrow, and on the sides enclosing elongate spaces so as to recall the pattern found in the ocelots. Lower cheek-line less developed than usual. Nape with two strongly defined and two less defined lines outside them, but all are very narrow, and in some cases, as in the type, the central pair are themselves longitudinally split by a pale line. Black markings of posterior back forming a double series of broken lines one to three inches in length on each side of the pale middle line. Laterally the markings take the form of rosettes, rounded on the shoulders and hips, obliquely elongate on the flanks; the bordering lines of these markings are deep black, sharply defined, and rarely more than about  $\frac{1}{4}$  inch in diameter. Central space of rosettes also grey, slightly darker than the general ground-colour. Under surface white, a prominent black line across below jaw, another less prominent across chest (in the type this latter is replaced by two lines of spots), and a number of round black spots on belly. Limbs buffy grey on outer, white on inner aspect, the spots continued down to the proximal part of the hands and feet. Tail marked with 11 or 12 black and buffy-white rings, the dark and the light about equally broad.

Skull in general shape like that of *F. Wiedii*, but more heavily ridged. Brain-case smaller, narrower, more constricted behind the postorbital processes, and more parallel-

\* Schr. Säug. pl. cvi. (1775). The publication of this plate antedates that of the text, and as it is a copy of Buffon's plate, the animal figured by the latter—which is from Cayenne—may be taken as its type.

sided, so that its breadth measured across its frontal region more nearly approaches that of its greatest parietal breadth. Upper profile of skull gently and evenly convex, not markedly more rounded at the vertex.

Dimensions of the type, measured in skin:—

Head and body (overstretched, c.) 600 millim.; tail 410; hind foot 108; ear 48. (Of another specimen, male, measured by P. O. Simons in the flesh: head and body 559; tail 333; hind foot 110; ear 50.)

Skull: greatest length 94·5; basal length 82; zygomatic breadth 63; nasals, length in middle line 16·5; interorbital breadth 18; tip to tip of postorbital processes 49; postorbital constriction 30·5; breadth of brain-case on frontals 38; ditto across parietals 43; palate length 35; length of bulla 20·5; length of  $p^+$  11.

*Hab.* of type. Beltran, Jalisco, Mexico. Other specimens from Tatamales, Sinaloa (*Simons*), and N. Yucatan (*Gau-mer*).

*Type.* Female. B.M. no. 90.1.4.1. Collected 25th April, 1889, by W. Lloyd, and presented by F. D. Godman and O. Salvin.

This grey Mexican representative of the *F. Wiedii* group contrasts markedly in colour with the tawny forms found to the south of it from Costa Rica to S. Brazil.

I can find no tenable name applicable to this species, that of *F. mexicana*, de Sauss., being antedated several times over in other groups of the genus. Its earliest use appears to have been by Kerr in 1792, who applied it to an ocelot.

In Group III. the following is a description of two fresh specimens apparently assignable to the little-known *F. pardinoides*, Gray, to which Hensel's "*F. guigna*, Mol.," should also be referred:—

Size comparatively small. Fur rather harsh and close. General colour dark, owing both to the dark tone of the ground-colour and the closeness of the spotting. Ground-colour along dorsal area light fulvous, becoming markedly lighter on the sides and white on the belly. Face with the usual white supraorbital line, interrupted black frontal lines, and the two black lines running back on the cheeks to below the ear. Back of ears black, with the usual whitish patch small but well defined. Top of neck with an indistinct black median line, outside which there are two pairs of strong clearly defined black lines, and a third less defined one on the level of the outer base of the ear. The narrow central



black lines are continued interruptedly down the back on to the rump, but laterally and on the shoulders the lines change into rosettes, which are about an inch in diameter, with dark fulvous centres. Then below on the belly and on the limbs the rosettes again pass into black spots. Chin, chest, and groins white, with but little spotting; belly heavily spotted. Limbs dull yellowish fulvous, the spots getting smaller terminally, being only about  $\frac{1}{4}$  inch in diameter on the metapodials and disappearing on the digits. Tail rather short, with 11 to 13 black rings, which are slightly broader than the light spaces between them.

Skull small and delicate, very smooth, and without any trace of ridges or crests, with the usual exception of the lambdoid crest, and even this is low and little developed. Face short. Nasal region pinched in, but not markedly convex above, the profile running in an even scarcely convex line to the vertex. Postorbital processes small and weak, the brain-case but little constricted behind them. Bullæ high and well inflated.

Dimensions of the male, measured in the flesh :—

Head and body 500 millim.; tail 255; hind foot 105; ear 38.

Skull: greatest length 83; basal length 71.5; zygomatic breadth 49.5; nasals, length in middle line 16.5; greatest breadth 11.6; middle breadth 5.2; interorbital breadth 14.2; tip to tip of postorbital processes 32; intertemporal breadth 25; length of brain-case from between postorbital processes 51; breadth of brain-case 39; palate length 31; length of bulla 17; length of upper incisive row 10; length of  $p^4$  on outer edge 9.6, of  $m_1$  8.

*Hab.* Espiritu Santo. Coll. A. Robert.

Compared with this, the Central-American representative of the group may be distinguished as follows :—

*Felis pardinoides oncilla*, subsp. n.

Size and general characters as in true *F. pardinoides*. Fur of about the same length, and similarly directed backwards on the nape, but much softer and richer throughout. Ground-colour much richer and deeper, and scarcely lightening on the sides or limbs; it is something near Ridgway's clay-colour, but darker and glossier. Black lines of head and nape very strong, but the indistinct median dark nuchal line not present. Posterior back with a strong central black line, outside which rosettes begin to form at once. Lateral rosettes but little elongated, their centres much darker than

the general ground-colour. Under surface brownish clay-colour, dull whitish on the chin; chest and groins scarcely lighter at all, instead of the white of true *pardinoides*. Hands and feet dull brownish clay-colour, some fine spots present on the metapodials. Tail much blacker above than in the southern form, the black rings very broad, and the light ones (of which about 8 or 9 may be counted) very narrow; below, on the other hand, it is clay-colour for three fourths its length, with indistinct black annulations, the tip broadly black-ringed.

Dimensions of the type, measured in skin:—

Head and body 505 millim.; tail 290; hind foot 105; ear 39.

*Hab.* Volcan de Irazu, Costa Rica.

*Type.* B.M. no. 78. 7. 6. 3. Collected by Mr. Rogers and presented by F. DuCane Godman, Esq.

The skull of this cat is unfortunately lost, but as its relationship to *F. pardinoides* is quite clear, I nevertheless venture to describe it. It differs from that animal by its much darker and richer general colour, especially its darker underside and darker limbs, its softer fur, and the great breadth of the black bands of the upper surface of its tail.

*Felis pardinoides andina*, subsp. n.

Intermediate in general colour between *F. p. oncilla* and the typical *pardinoides*, the upper surface and limbs more as in the former, though slightly lighter, the under surface with the white chin, throat, chest, and groins of true *pardinoides*. Fur quite soft, markedly softer and richer than in *pardinoides*. Tail coloured about as in *pardinoides*, not with the broad black bands of *oncilla*.

Skull decidedly larger than in *pardinoides*; nasals longer; frontal region broader; mesopterygoid fossa longer, mainly owing to the palate ending rather further forward, almost level with the back of the molar; bullæ comparatively small. Teeth, especially carnassials, large and heavy.

Dimensions of the type, measured in skin:—

Head and body 520 millim.; tail 290; hind foot 109; ear 41.

Skull: greatest length 86; basal length 73.5; zygomatic breadth 53.5; length of nasals 18; interorbital breadth 14; tip to tip of postorbital processes 36; postorbital constriction 28; breadth of brain-case 41; palate length 30; outside length of  $p^4$  10.7.

*Type.* (Apparently) male. B.M. no. 77. 4. 3. 4. Collected by Mr. Clarence Buckley.

*Hab.* Jima, Province of Azuay, Ecuador. Altitude 2400 metres.

This Andean form of the group may be distinguished from *pardinoides* by its softer fur and larger skull, and from *oncilla* by its lighter underside and light narrowly ringed tail.

*Felis salinarum*, sp. n.

Generally similar to *F. Geoffroyi*, but much smaller.

Fur thin and shaggy. Hairs of nape not reversed. General colour sandy buff. Spots very numerous, quite small, not connected into lines, except on the nape. Cheek-lines narrow and inconspicuous. Ears large, the white patch on their backs large, and extending downwards to their outer base. Nape with two narrow continuous black lines on each side of the middle line, and two more interrupted and less well-marked lines outside them. Chin white; throat buffy; chest and groins white, belly sandy; a black line across the interramia, another on the throat, and a number of black spots, larger than those on the upper surface, on the belly. Limbs sandy on their outer, whiter on their inner surfaces, strongly banded proximally, the spots dying away on the metapodials. Tail sandy, irregularly marked above only proximally, ringed terminally.

Skull scarcely exceeding in length that of *F. oncilla*, consequently much smaller than that of *F. Geoffroyi*. Post-orbital processes well developed. Brain-case broadly rounded, but more contracted anteriorly than in the *F. Wiedii* group.

Dimensions of the type, measured in the flesh:—

Head and body 435 millim.; tail 265; hind foot 97; ear 37.

Skull: greatest length 84.5; basal length 71; zygomatic breadth 56.5; length of nasals in middle line 17; inter-orbital breadth 15.5; tip to tip of postorbital processes 38; postorbital constriction 26.5; breadth of brain-case 41.5; palate length 32; length of upper incisive row 10; length of  $p^4$  on outer edge 10.7.

*Hab.* of type. Cruz del Eje, Central Cordova. Alt. 600 m.

*Type.* Female. B.M. no. 2.2.5.10. Original number 1713. Collected 28th November, 1901, by the late P. O. Simons. One specimen.

This is a small northern representative of *F. Geoffroyi*, and was rightly distinguished as such by Dr. Matschie\*,

\* SB. Ges. nat. Fr. Berlin (1894), p. 59.

who records examples from Jujuy and Tucuman, using for it the name of *F. guigna*, Mol. But Molina's animal, first described from "Chili," was afterwards identified by Philippi \* with a cat from Valdivia, in the southern part of that country, which may therefore be taken as its type locality. Now it is inconceivable that, while on the eastern side of the Andes a northern and a southern form are found, separated at about lat. 32° S., the Valdivian one, at nearly 40° S., should be the same as the *northern* one of the two eastern forms. On the other hand, it is by no means unlikely that *F. guigna* and *F. Geoffroyi* will prove to be the same, as in the south the Andes do not present the same faunistic barrier that they do further north.

*Hapale flaviceps*, sp. n.

General characters of *H. penicillata*, with which it shares the size, grizzled body-colour, with its tricolor fur, the suppressed banding of the back, the distinct ringing of the tail, and the whitish or yellowish hands and feet. But the whole of the head is buffy yellow, rather whiter on the muzzle, and the preauricular tufts are practically absent, being replaced by long tufts of yellowish-white hairs situated on the inner aspect of the ear-conch. Throat yellowish. Middle line of belly and anal region black.

Dimensions of the type (measured in the flesh):—

Head and body 248 millim.; tail 298; hind foot 65; ear 23.

*Hab.* Engenheiro Reeve, Espiritu Santo.

*Type.* Female. Original number 1220. Collected 11th February, 1903, by Alphonse Robert. Three specimens.

*Oryzomys sublineatus*, sp. n.

A northern representative of *O. dorsalis*, Hensel, with harsher fur, broader skull, and concave anterior zygoma-root.

Size about as in *O. dorsalis*, or rather larger; tail shorter in proportion. Fur comparatively harsh and short; hairs of back about 8 millim. in length. General colour above dull grizzled greyish or "bistre," coarsely lined with buffy. An indistinct blackish line along the posterior half of the spine. Cheeks and sides slightly more buffy than the back. Under surface short-haired, dull buffy whitish, not very sharply defined on the sides; bases of hairs slaty. Ears

\* Arch. f. Nat. xxxix. p. 8 (1873).



short, finely haired, brown. Outer sides of arms and legs greyish, inner sides whitish; hands and feet wholly white. Tail rather short for this group, finely haired and scaled, greyish brown above, rather whiter below.

Skull broad and flattened, with widely expanded zygomata. Interorbital region smoothly rounded laterally, flattened above, without any trace of ridges; anterior edge of zygomatic plate concave, with a projecting point above, an unusual structure in this group; palatal foramina large and widely open, not reaching back to the level of  $m^1$ ; back of palate level with the hinder edge of  $m^3$ .

Dimensions of the type, measured in the flesh:—

Head and body 140 millim.; tail 111; hind foot, s. u. 27, c. u. 29; ear 19.

Skull: tip of nasals to back of frontals 23; zygomatic breadth 18; length of nasals 13; interorbital breadth 5.1; palate length 14.2; diastema 9.2; palatal foramina  $7.2 \times 3.1$ ; length of upper molar series (much worn) 4.8.

*Hab.* Engenheiro Reeve, Inland of Victoria, Prov. Espirito Santo, Brazil. Alt. 500 m.

*Type.* Old male. Original number 1224. Collected 14th February, 1903, by Mr. Alphonse Robert. One specimen.

This coarse-haired *Oryzomys* is allied to the *O. dorsalis* of Rio Grande do Sul, to which it shows its affinity by its dark dorsal line and smooth interorbital region, but from which it differs by the details above mentioned.

#### *Akodon suffusus*, sp. n.

Closely allied to *A. hirtus*, Thos., but the general colour stronger, the belly lighter, and with certain cranial differences detailed below.

Fur close, soft, and thick, about 11 millim. long on the back. General colour of the dorsal area grizzled olivaceous yellow (rather darker than Ridgway's "tawny olive"), this colour running forwards on to the crown, but passing on the cheeks and sides into cinereous grey. Under surface whitish, lighter and more sharply defined than in *A. hirtus*; the bases of the hairs slaty as usual. Ears short, well-haired, brown, an inconspicuous whitish spot at their bases. Hands and feet white. Tail well-haired, sharply bicolor, dark brown above, white below.

Skull in general shape like that of *A. hirtus*, not elongated as in *A. longipilis*. But it is rather lower and flatter throughout, less rounded and convex along the middle line, especially in the interorbital region. Anteorbital plate narrow (width 1.7 millim. as against 2.1). Palatal foramina

comparatively short. Hinder edge of palate some distance behind last molar. Molars small and light.

Dimensions of the type, measured in the flesh:—

Head and body 110 millim.; tail 77; hind foot, s. u. 22, c. u. 24; ear 14.

Skull: greatest length 27·5; basilar length 21·3; greatest breadth 14; nasals 11; interorbital breadth 4·8; breadth of brain-case 12·2; palate length 11·2; diastema 7; palatal foramina 6·1; length of upper molar series 3·4.

*Hab.* Valle del Lago Blanco, Southern Chubut (Cordillera region).

*Type.* Male. Original number XVI. Collected 6th August, 1900, by Mr. J. Koslowsky. About forty specimens examined.

*Akodon* (*Chelemys*, subg. n.) *vestitus*, sp. n.

[CHELEMYS\*, subg. n.

General characters, skull, and dentition as in *Akodon*, but the claws, especially the anterior ones, very large, fossorial.

*Type*, *Akodon megalonyx*, Waterh.

Now that the known species have been so considerably multiplied, it seems convenient to have a subgeneric name by which to designate what have been hitherto termed the "long-clawed Akodons."]

General appearance and proportions very much as in *A. (C.) macronyx*, Thos., but colour darker, tail more distinctly bicolor, and skull broader and flatter.

Fur very long, close, and woolly; hairs of back about 10–11 millim. in length. General colour above darker than in *A. macronyx*, approximately resembling Ridgway's "sepia" or "olive." Sides paler, approaching "broccoli-brown." Underparts dull white, well defined on the sides for such a thick-furred animal, the slaty bases to the hairs showing through. Ears short, scarcely projecting above the fur, well-haired, brown. Arms and inner sides of legs greyish white; hands and feet wholly white. Tail well-haired, distinctly and sharply bicolor, dark brown above, white below.

Skull, as compared with that of *A. macronyx*, broader, more flattened, and less cylindrical, with more widely expanded zygomata; interparietal rather smaller. Teeth as in the allied species.

\* χηλή, a hoof or claw.

Dimensions of the type, measured in the flesh:—

Head and body 127 millim.; tail 57; hind foot, s. u. 23, c. u. 25; ear 15.

Skull: greatest length 30; basilar length 24.4; zygomatic breadth 17; nasals 11.1; interorbital breadth 4.7; breadth of brain-case 14; palate length 12.8; diastema 7.8; palatal foramina 7; length of upper molar series 5.3.

*Hab.* Valle del Lago Blanco, Cordillera region of Southern Chubut Territory, Patagonia.

*Type.* Male. Original number I. Collected 28th September, 1900, by Mr. J. Koslowsky. Ten specimens examined.

This species is the southern representative of *A. macronyx*, Thos., to which it is no doubt very nearly allied; but the fresh series now available indicates that it should have a name of its own.

In company with the series of *A. vestitus* there are two examples of the other long-clawed southern group *Notiomys*, distinguishable by its very small and comparatively brachyodont molars from the more or less hypsodont *Akodon*, but I cannot definitely determine their species. From the descriptions given it seems not impossible that both "*Hesperomys (Akodon) Michaelsoni*," Matschie, and "*Oxymycterus microtis*," Allen, belong to *Notiomys*, as their long claws, short tails, and very small molars agree precisely with what is found in that group.

*Ctenomys Azaræ*, Thos.

*Ctenomys Azaræ*, Thos. Ann. & Mag. N. H. (7) xi. p. 228 (1903).

The locality of this animal proves unfortunately to have been wrongly given in the above description.

The specimens were presented to the British Museum by Señor Maximo Hopff, of Buenos Ayres, who handed them to the British Consulate there for transmission home. It happened, however, that a collection of Mr. W. Foster's was coming home by the same intermediary, and Mr. Hopff's specimens, which were not labelled, got placed with the latter and were considered to be part of it.

Now, however, enquiry shows that the specimens were obtained in the Province of Buenos Ayres, on the central pampas, lat. 37° 45' S., long. 65° W., 780 kilometres south-west of the capital, a region from which no examples of *Ctenomys* had previously been recorded.

XIX.—*Report on a Collection of Echinoderms from the Neighbourhood of Zanzibar.*—Part I. By F. JEFFREY BELL, M.A.

THE zeal for the study of natural history which distinguishes H.M. Agent at Zanzibar, Sir Charles Eliot, K.C.M.G., led that diplomatist to obtain the assistance of Mr. Crossland, B.A., who made, *inter alia*, a collection of Echinoderms. As reports on various groups are being or have been made, it seems well that there should be one on the Echinoderms; but I am bound to be brief, since in 1899 a very complete account of the Echinoderm fauna of this area was given by Prof. Ludwig\*, who enumerated 127 species as being known from the district.

It will probably be convenient if on this occasion I adopt the systematic order of Prof. Ludwig's memoir. The Crinoidea and Holothurioidea will be dealt with in the second half of this report.

#### ASTEROIDEA.

##### Astropectinidæ.

1. *Astropecten Hemprichii*, M. Tr.  
Zanzibar Channel, 8 fath.
2. *Astropecten polyacanthus*, M. Tr.  
Zanzibar, 3-5 fath.
3. *Luidia Savignii*, Audouin.  
Wasin, 10 fath.

##### Pentagonasteridæ.

4. *Goniodiscus* yg.

There are several specimens differing in size and in some important points; we have really no knowledge of the growth-changes of species of this genus, and our collections must be much larger before we make any new species.

5. *Pentaceros Lincki*, de Bl.

This is the form catalogued by Prof. Ludwig as *P. muricatus* of Linck, but that zoologist was not a binominalist.  
Zanzibar shore.

\* "Wissenschaftliche Ergebnisse der Reisen in Madagascar u. Ost-Afrika . . . von Dr. A. Voeltzkow. i. 4. Echinodermen des Sansibar-gebietes," Abh. Senckenb. Ges. xxi. 4 (1899).



6. *Pentaceros hiulcus*, M. Tr.

Zanzibar.

7. *Pentaceros* yg., ? *hiulcus*.

Wasin.

8. *Culcita pentangularis*, Gray.

Zanzibar.

Asterinidæ.

9. *Asterina cepheus*, Val.

Zanzibar, 10–20 fath.

Linckiidæ.

10. *Ophidiaster fuscus*, Gray.

This species is not in Prof. Ludwig's list, and, so far as I know, the only author who has discovered specimens of it since Gray described it is Prof. Studer, who has given an account of his examples in the report on his 'Gazelle' Asteroids (see Phys. Abhand. Berl. Akad. 1884, p. 29). I am permitted to say that in the statement that there are eight rows of plates on the arms the figure 8 was misprinted for 3.

Zanzibar, 3–5 fath.

11. *Leiaster coriaceus*, Peters.

Wasin.

I am indebted to Dr. Meissner, of the Berlin Museum, for kindly comparing the specimens in Mr. Crossland's collection with Peters's types. Peters's description and that given and illustrated by M. de Loriol \* were almost sufficient for me; but I thought it better to ensure accuracy by making a call on Dr. Meissner's kindness.

12. *Linckia Ehrenbergi*, M. Tr.

Zanzibar.

13. *Linckia marmorata*, Michelin.

Zanzibar, 10 fath.

14. *Nardoa variolata*, Retzius.

Zanzibar, shore.

\* Mém. Soc. Phys. Genève, xxix. 4 (1885), p. 37, pl. xiii.

## Pterasteridæ.

15. *Retaster cribrosus*, v. Martens.  
Zanzibar, shore, and Wasin, 7 fath.

## Echinasteridæ.

16. *Mithrodia clavigera*, Lamk.  
Wasin, 10 fath.
17. *Echinaster purpureus*, Gray.  
Wasin.

## OPHIUROIDEA.

It is very curious that there should be only three Ophiuroids: of these one is of great rarity; it was described from specimens collected by H.M.S. 'Alert.'

18. *Ophioplocus imbricatus*, M. Tr.  
Zanzibar.
19. Fragments of what appeared to be *Ophiomyxa australis*, Lütken.
20. *Ophioteresis elegans*, Bell.  
Found nestling in the arms of a many-armed *Actinometra* from Zanzibar.

## ECHINOIDEA.

## Cidaridæ.

21. *Cidaris metularia*, Lamk.  
Zanzibar; Wasin, 7 fath.
22. *Leiocidaris verticillata*, Lamk.  
Wasin, 10 fath.
23. *Leiocidaris baculosa*, Lamk.  
Wasin, 10 fath.

## Diadematidæ.

24. *Diadema saxatile*, L.  
Wasin, 10 fath.

25. *Astropyga radiata*, Leske.

Wasin, 10 fath.

Echinidæ.

26. *Salmacis bicolor*, Ag.

Zanzibar ; Wasin, 10 fath.

27. *Salmacis sulcata*, Ag.

Zanzibar, 5 fath.

28. *Hipponoe variegata* \*, Leske.

Zanzibar, 4 fath.

29. *Tripneustes gratilla*, L.

Zanzibar.

30. *Echinostrephus molare*, de Bl.

Zanzibar.

Echinometridæ.

31. *Echinometra oblonga*, de Bl.

Zanzibar, shallow water.

32. *Parasalenia gratiosa*, A. Ag.

Wasin, 10 fath.

Clypeastridæ.

33. *Clypeaster reticulatus*, L.

Wasin, 10 fath.

34. *Laganum depressum*, Lesson.

Wasin, 10 fath.

35. *Echinodiscus auritus*, Leske.

Wasin.

Cassidulidæ.

36. *Echinoneus cyclostomus*, Leske.

Zanzibar and Momba.

\* Misprinted by Prof. Ludwig's printer "*variegosta*."

## Spatangidæ.

37. *Maretia planulata*, Lamk.

Zanzibar, 10-20 fath.

38. *Lovenia elongata*, Gray.

Wasin, 10 fath.

39. *Schizaster gibberulus*, Ag.

Wasin, 7 fath.

This is an addition to Prof. Ludwig's list.

XX.—*Rhynchotal Notes*.—XVIII. Heteroptera.

By W. L. DISTANT.

THE following descriptions of new genera and species of Heteroptera are based on specimens recently acquired by the British Museum. They are principally from the Malayan Archipelago, and were all collected by the late Mr. Doherty, except two species from Key Island received through another source.

## Order RHYNCHOTA.

## Suborder HETEROPTERA.

## Family Pentatomidæ.

Subfam. *PLATASPIDINÆ*.*Coptosoma mirabilis*, sp. n.

Luteous; two large central spots at base of head, a large subcruciform fascia on anterior area of pronotum, three longitudinal fasciæ united posteriorly and widened anteriorly on posterior area of pronotum, the lateral pronotal angles, two transverse discal fasciæ, and the lateral and apical margins of scutellum black, shining; the scutellar area between the two discal fasciæ coarsely brownly punctate; sternum slaty grey, margin of prosternum and legs luteous; abdomen black, lateral margins broadly and inwardly dentately luteous; antennæ luteous, apex fuscous. Head short, broad, moderately rounded between the eyes; lateral margins of pronotum emarginate in front of the lateral angles; scutellum without a basal callosity; body broad, widened posteriorly.

Long. 4 millim.

*Hab.* Halmageira (*Doherty*, Brit. Mus.).



Subfam. *SCUTELLERINÆ*.*Brachyaulax majuscula*, sp. n.

Head and pronotum black; anterior and posterior margins of anterior pronotal lobe, a discal anterior spot on each side of posterior lobe, and the hind margins of posterior angles pale bluish, a large marginal spot on anterior half of posterior pronotal lobe, equally continued beneath into base of prosternum, sanguineous; scutellum pale bluish; basal discal elevation connected medially with a broad submedial fascia which does not reach margins except posteriorly by the aid of a small marginal spot, a subapical fascia reaching margins and centrally sinuated anteriorly and posteriorly, and the apex black; body beneath and legs black, pilose, lateral areas of sternal and abdominal segments streaked with pale bluish, lateral margins enclosing black stigmal spots and inwardly irregularly dentately sinuate, sanguineous; rostrum and antennæ black, the last finely pilose.

Long., ♀,  $20\frac{1}{2}$  millim.; exp. pronot. angl.  $9\frac{1}{2}$  millim.

*Hab.* Key Island (Brit. Mus.).

Allied to *B. rufo-maculata*, Stål, which it much resembles above, but differs by its much greater size and by the different colour of the abdomen beneath; in the last character and size it most agrees with *B. Kükenthali*, Bredd., from which it is at once separated by the characters of the upperside.

*Philia Dohertyi*, sp. n.

Black; head, anterior area of pronotum, and basal and subapical areas of scutellum shining cupreous; lateral and apical margins to head, anterior lateral margins of pronotum, and lateral margins of scutellum pale olivaceous green; coxæ, trochanters, femora, basal margin of metasternum, first and second joints of rostrum, and very broad lateral margins to abdomen luteous; head and prosternum pale olivaceous green; abdomen tinged with cupreous on posterior segmental margins; antennæ black; pronotum with a transverse series of coarse punctures posteriorly defining the anterior cupreous area; scutellum finely punctate, the punctures coarse on anterior lateral margins; rostrum passing the posterior coxæ; the broad lateral luteous margins to the abdomen moderately crossed interiorly.

Long.  $12\frac{1}{2}$  millim.; exp. pronot. angl. 7 millim.

*Hab.* Islands Jobie and Salawati (*Doherty*, Brit. Mus.).

*Calliphara lanceolata*, sp. n.

Sanguineous ; head, above and beneath, lateral angles and a broad central longitudinal fascia to pronotum, a central basal longitudinal spot and apex of scutellum, connexivum, and basal lateral margin of corium shining olivaceous green ; base of head, the sternum and femora pale ochraceous ; apices of femora, tibiæ, tarsi, and apex of abdomen olivaceous green ; rostrum and antennæ black ; second, third, and fourth joints of antennæ subequal in length ; membrane projecting a little beyond abdominal apex ; rostrum just passing posterior coxæ ; lateral margins of corium exposed for about one-third the length of the scutellum.

Long. 17 millim. ; exp. pronot. angl.  $8\frac{1}{2}$  millim.

*Hab.* Tenimber Island (*Doherty*, Brit. Mus.).

*Calliphara rostrata*, sp. n.

Sanguineous ; head, pronotum, exposed basal marginal area of hemelytra, a very broad central fascia to scutellum, which is produced and biangulate anteriorly and subtruncate posteriorly, two subapical small central contiguous spots, head beneath, rostrum, antennæ, legs, and apex of abdomen bluish black ; body above sparsely and finely punctate ; abdomen beneath finely centrally sulcate, containing the rostrum, which reaches the base of the apical abdominal segment ; tibiæ sulcated above ; abdomen beneath without lateral punctures.

Length  $18\frac{1}{2}$  millim. ; exp. pronot. angl. 9 millim.

*Hab.* Key Island (Brit. Mus.).

Allied to the group of species represented by *C. Billardieri*, Fabr. ; to be distinguished by the very long rostrum, &c.

Subfam. *PENTATOMINÆ*.

## BARACELLUS, gen. nov.

Head longer than broad at base behind eyes, anteriorly concave, the lateral lobes upwardly reflexed, a little longer than central lobe, antennæ five-jointed, first joint passing apex of head, second joint but slightly longer than third ; rostrum just passing the intermediate coxæ ; pronotum with the lateral margins serrate, the posterior angles longly produced and also serrate ; scutellum elongate, subtriangular, the apex prominently narrowed ; corium nearly reaching the apex of the fifth abdominal segment ; abdomen obscurely centrally sulcated, apical angles of the sixth abdominal segment acutely produced ; legs unarmed.

I place this genus near *Coccoteris*.

*Baracellus lanceolatus*, sp. n.

Head, antennæ, rostrum, and body beneath luteous; head sparingly darkly punctate, eyes black; pronotum olivaceous, sparingly coarsely darkly punctate, posterior lateral margins and a central levigate spot on anterior disk ochraceous, posterior margin reddish ochraceous, lateral angles longly spinously produced, black, their anterior margins ochraceous, apices reddish ochraceous, coarsely granulate, subacute, their margins longly laterally serrate; scutellum pale reddish ochraceous, coarsely darkly punctate, with an olivaceous spot before apex, which is finely punctate; corium olivaceous, coarsely punctate; membrane pale ochraceous, semihyaline, tinged with reddish ochraceous at base, just passing abdominal apex; posterior area of prosternum, posterior margin of metasternum, and spots near coxæ pale olivaceous; legs greenish ochraceous; apex of rostrum piceous.

Long. 27 millim.; exp. pronot. angl.  $12\frac{1}{2}$  millim.

*Hab.* Island of Jobie (*Doherty*).

Family **Lygæidæ**.Subfam. *LYGÆINÆ*.*Melanotelus timorensis*, sp. n.

Dull sanguineous, greyishly pilose; head, antennæ, a subquadrate spot at each lateral angle of the pronotum, anterior margin and two small discal spots to scutellum, membrane, head beneath, rostrum, sternum, legs, and apical segment of abdomen black or piceous; membrane with a broad apical spot and narrow basal margins greyish white; lateral margins of sternum dull sanguineous; head, pronotum, and corium pilose, scutellum glabrous; membrane not quite reaching the abdominal apex; legs rather longly pilose.

Long. 5 millim.

*Hab.* Timor (*Doherty*).

Subfam. *BLISSINÆ*.*Macropes Humboldti*, sp. n.

Piceous; basal joint of antennæ, apex of head, rostrum, legs, and extreme lateral margins of abdomen reddish ochraceous; corium pale yellowish white, membrane creamy white, the veins dark piceous; head, pronotum, scutellum, abdomen above, and body beneath thickly greyish pilose; a central discal fascia and a narrower subbasal fascia to pronotum

glabrous black; antennæ with the basal joint moderately incrassate, short, but passing apex of head, second joint longer than third, remainder mutilated; anterior femora prominently incrassated, granulate, finely spined beneath.

Long. 8 millim.

*Hab.* Humboldt Bay (*Doherty*).

Subfam. *COLOBATHRISTINÆ*.

*Artemidorus ornatus*, sp. n.

Head, pronotum, scutellum, rostrum, and body beneath indigo-black; two large discal elongate spots on posterior pronotal lobe, apex of scutellum, and three large spots on each lateral abdominal margin luteous; corium luteous, coarsely blackly punctate, suffused with piceous about centre and near apex; membrane black, its base obscure luteous; legs ochraceous, apices of the posterior femora and tibiæ black; antennæ mutilated. Pronotum coarsely and sparingly punctate, lateral margins distinctly hirsute and centrally sinuate, transverse impression profound, lobes of about equal length, posterior margin moderately concavely sinuate, lateral angles subnodulose, posterior lobe obscurely centrally carinate; scutellum long, not quite half the length of corium, with a discal carination, its apex subacute; membrane just passing abdominal apex.

Long., ♀, 11 millim.

*Hab.* Bonthain Peak (*Doherty*).

*Artemidorus sobrinus*, sp. n.

Above ochraceous, darkly punctate; head, anterior lobe of pronotum (excluding anterior margin), base of scutellum, and body beneath black; femora and tibiæ ochraceous; apex of scutellum, coxæ, trochanters, bases of femora, basal joint of tibiæ, and three spots on each lateral margin of abdomen, of which the central is the smallest, pale luteous; posterior femora (excluding base), intermediate and posterior tibiæ, and apices of the tarsi black or piceous; antennæ brownish ochraceous. In structure much resembling the preceding species, *A. ornatus*, but membrane not reaching the abdominal apex, posterior pronotal lobe distinctly centrally carinate, more coarsely punctate than anterior lobe; scutellum and corium sparingly but profoundly punctate, apices of corium piceous; membrane cupreous, its base piceous, margined with greenish opalescence.

Long., ♀, 8 millim.

*Hab.* Bali (*Doherty*).



## Family Reduviidæ.

Subfam. *EMESINÆ*.*Myiophanes pilipes*, sp. n.

Pale luteous; head, antennæ, posterior lobe of pronotum, meso- and metasterna, basal annulation to abdomen, a central and marginal series of linear spots and apex to abdomen beneath, rostrum, a broad basal and subapical annulation to anterior coxæ, three very broad annulations to anterior femora, anterior tibiæ (excluding bases), dark fuscous; intermediate and posterior legs brownish ochraceous, apices of femora and bases of tibiæ creamy white; anterior legs rather longly pilose; intermediate and posterior legs and abdomen very longly and thickly pilose on each side; antennæ with the first joint about equal in length to intermediate femora and longly pilose on each side, second joint equal to first and much more shortly pilose; hemelytra and wings pale brownish ochraceous.

Long.  $17\frac{1}{2}$  millim.; exp. hemelytra 32 millim.

*Hab.* Australia; Richmond River (Brit. Mus.).

## EUGUBINUS, gen. nov.

Elongate, apterous; head globose on disk, anteocular area shorter than postocular, base constricted and somewhat pedunculate at base, eyes large and prominent; rostrum reaching the anterior coxæ, first and second joints incrassated and almost subequal in length, basal joint strongly curved, second joint passing eyes; antenniferous tubercles long, slender; antennæ slender, first joint about as long as head and pronotum together; pronotum with the anterior lobe shorter than the posterior, broadest and truncate anteriorly, attenuated posteriorly but not pedunculate, posterior lobe elongate, margins subparallel; anterior coxæ shorter than anterior tibiæ, which are about one-third shorter than anterior femora, the last finely spined for almost their entire length with a prominent spine near base; posterior femora passing abdominal apex; posterior tibiæ considerably longer than the femora; anterior tarsi short, rigid, two-jointed, basal joint shortest.

This genus belongs to the division *Emesaria*, Stål.

*Eugubinus araneus*, sp. n.

Pale obscure ochraceous; head (excluding apex) black; pronotum with brownish marks and suffusions; antennæ, legs, and rostrum pale creamy white, somewhat thickly annulated

with brown; intermediate and posterior coxæ, trochanters, and spots to apical segment of abdomen piceous; anterior coxæ and femora each with two broad brown annulations, anterior tibiæ with three annulations, apex of anterior tarsi and the intermediate and posterior tarsi fuscous; rostrum with the second joint annulated with brown; antennæ, intermediate and posterior legs much and closely annulated with brown.

Long.  $8\frac{1}{2}$  millim.

*Hab.* Urun, near Bombay (*Aitken*, Brit. Mus.).

Found living in nest of a spider (*Theridium* sp.).

## XXI.—*Note on a Fossil Eel from the Scandinavian Chalk.*

By A. SMITH WOODWARD, LL.D., F.R.S.

THERE is no longer any doubt that well-differentiated eels occur as fossils in the Chalk. Nearly complete skeletons from two formations in the Lebanon\* exhibit only one essential difference from a modern generalized eel, namely, the presence of a separate caudal fin, which has subsequently disappeared. Well-preserved remains of the head from the English Chalk† show that the cranial osteology of the Cretaceous fish is identical with that characteristic of the suborder Apodes in the existing fauna.

It is curious that so highly specialized a type of fish as the eel should date back to the Cretaceous period. It is still more remarkable that it should prove to have been widely distributed at that remote time. Continual discoveries, however, seem to indicate that it was an essential element of the later Cretaceous fish-fauna. I have recently examined a new specimen which extends its known range to Scandinavia.

This interesting fossil was obtained from the Danian Chalk of Limhamn, near Malmö, in Southern Sweden, and is now preserved in the Museum of the University of Lund, where Prof. J. Christian Moberg has kindly permitted me to study it. It was originally mentioned by Dames‡ as possibly belonging to the family Gadidæ, and was subsequently

\* *Urenchelys avus* and *U. hakeiensis*, A. S. Woodward, Catal. Foss. Fishes B. M. pt. iv. (1901) pp. 337, 338, pl. xviii. figs. 1-3.

† *Urenchelys anglicus*, A. S. Woodward, Ann. & Mag. Nat. Hist. [7] vol. v. (1900) p. 321, pl. ix. fig. 1.

‡ W. Dames, "Ueber Vogelreste aus dem Saltholmschalk von Limhamn bei Malmö," Bihang k. Svensk. Vet.-Akad. Handl. vol. xvi. sect. iv. no. 1 (1890), p. 3.

described by Davis \*, as one of the Cretaceous Dercetidæ, under the name of *Dercetis limhamnensis*. Both these determinations are undoubtedly erroneous, and the characters of the fossil, so far as preserved, are those of an Apodal fish.

As shown by the description and figure published by Davis (*loc. cit.*), this specimen comprises only the head, clavicle, and anterior part of the vertebral column of a long and slender fish. The head-bones are obviously thick and of open texture, quite unlike those of the Dercetidæ †; while the occipital and otic regions are sufficiently well preserved to indicate that they are eel-like and totally different from those of any known Gadidæ. All the remains, however, are in a crushed and broken condition, so that the details of the osteology are only vaguely observable. The teeth are very small and blunt. The vertebrae of the abdominal region are exposed from above or below, and chiefly remarkable for the large size of their transverse processes, which are laminar in form and taper to a point at their free end. These processes were correctly recognized by Lundgren and Dames, but were mistaken by Davis for scutes crushed upon the vertebral centra. The ribs are not preserved. A sigmoidally bent clavicle, exactly like that of an eel (described and figured by Davis as scapula), is displaced at some distance behind the head. There are no scales or scutes.

It is obvious that so imperfect a fossil cannot be satisfactorily determined either generically or specifically. The specimen, however, needs a name for reference. As it exhibits no characters separating it from the *Urenchelys* of the Lebanon Chalk, it may be provisionally referred to that genus. It is therefore to be regarded as representing a species, *Urenchelys limhamnensis* (Davis), which awaits adequate definition. It indicates a larger fish than the Lebanon species, and approaches *U. anglicus* in size.

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XXII.—*Notes on Hippoboscidæ (Diptera Pupipara) in the Collection of the British Museum.* By ERNEST E. AUSTEN.

THE following notes, which are chiefly concerned with synonymy and include no descriptions of new species, embody the conclusions at which the author has arrived while re-arranging

\* J. W. Davis, "On the Fossil Fish of the Cretaceous Formations of Scandinavia," Trans. Roy. Dublin Soc. [2] vol. iv. (1890) p. 431, pl. xlv. figs. 1, 2.

† A. S. Woodward, Catal. Foss. Fishes B. M. pt. iv. (1901) p. 185, pl. xii. fig. 4.

the Hippoboscidae in the British Museum (Natural History). Within the last few weeks the Museum has received from Mr. F. D. Godman the final instalment of the great collection of Central American Diptera worked out in the 'Biologia Centrali-Americana,' including the Hippoboscidae described by the late F. M. van der Wulp (*cf.* Biol. Centr.-Amer., Diptera, vol. ii. pp. 429-432, April 1903). An examination of these shows that van der Wulp's determinations in many cases need revision, as indicated below under the genera concerned. The present paper is printed in the hope that it may prove of some slight service to other workers at this interesting family of Diptera, which, although previously much neglected, has within the last few years been so fortunate as to receive attention at the able hands of Dr. P. Speiser.

#### HIPPOBOSCA, Linn.

*Hippobosca equina*, L.—In this species the amount of yellow on the scutellum varies very much, and sometimes this portion of the thorax is nearly all yellow, as shown in certain specimens in the British Museum collection from the neighbourhood of Biskra, Algeria (*Rev. A. E. Eaton*). The colour of the scutellum, therefore, cannot be used as a character to distinguish *H. equina*, L., from *H. Francilloni*, Leach, for which purpose the colour of the veins of the wings must be relied upon.

This species must be added to the list in van der Wulp's 'Catalogue of the Described Diptera from South Asia' (The Hague: Martinus Nijhoff, 1896), since the Museum collection contains a male from Celebes (purchased from E. Gerrard, jun., 1896) and a female from "Bengal" (no further details); while a male from Kalewa, Upper Burma, March 1893, "found on pony" (*Capt. E. Y. Watson*), apparently represents a pale variety. A male from Noumea, New Caledonia, June 1900 (*J. J. Walker, R.N.*), was recently presented by Mr. G. C. Champion.

*Hippobosca Francilloni*, Leach: *Memoirs of the Wernerian Natural History Society*, vol. ii. (1818), p. 554, tab. xxvi. figs. 8-10.—According to Speiser (*Zeitschr. f. Hymenopt. u. Dipt.*, ii. Jahrg. Heft 3 (1 May, 1902), p. 174), this species (of which *H. canina*, Rond., is a synonym) = *H. capensis*, v. Olfers, the type of which, from the Cape of Good Hope, is in the Museum für Naturkunde, Berlin. Von Olfers's



species was published in 1816\*; the paper in which Leach's species was described, though read on April 10, 1810, was not published until 1818. Thus, strictly speaking, von Olfers's name has two years' priority over Leach's; but since Leach was certainly not responsible for the delay of eight years in publishing his paper, the stringency of the law of priority may well be relaxed in his favour in this instance, and the name *Francilloni* may be allowed to stand.

*H. Francilloni*, which is well known in India and Ceylon as a pest of dogs, must be added to van der Wulp's catalogue already referred to. The Museum collection includes specimens from Kant, near Shahjahanpur, North-West Provinces, India, 29. xi. 1900 (*Lieut.-Col. Giles*); and others from Trincomali and Kanthalla, Ceylon (*Lieut.-Col. Yerbury*). We also possess specimens from Japan (*S. Bligh*), and a male from Seoul, Korea, 17. vii. 1900 (*Hon. E. Scarlett*), "caught on a Japanese dog." The species also occurs in Africa, and we have recently received a series of specimens from various localities, including Voi, Ndi, Mbuyuni, Makumbu, and Samburu, in British East Africa; in addition to these we possess specimens from "the interior of South Africa," presented in 1843 by the Earl of Derby. From North Africa we have specimens from Suez, Nov. 1901 (*F. Morey*). In 1901-1902 the species was obtained in Cyprus (Troodos, about 4500 feet, and near Ktima) by Miss D. M. A. Bate. It may be worth while to add that the Museum collection contains a female bearing the label "*Francilloni*" in Leach's handwriting, but it is impossible to say with certainty that this specimen is the actual type.

*Hippobosca camelina*, Leach: *op. cit.* p. 556, tab. xxvii. figs. 11-14.—The name *Hippobosca dromedarina* has recently been proposed by Dr. Speiser (*loc. cit.* p. 176) for *H. camelina*, Rond. (*nec* Leach), but I venture to think that the form referred to is not really distinct. The British Museum collection includes a long series of specimens of *H. camelina*, Leach, as also of *H. maculata*, Leach, and in both of these species there is a considerable variation (from ferruginous to deep brown) in the ground-colour of the thorax. Moreover, as shown by our specimens, in the case of *H. camelina* at any rate, the dark and light forms may occur in the same locality.

\* Not 1815, as stated by Speiser (*loc. cit.*): *Hippobosca capensis* was described in von Olfers's pamphlet, 'De Vegetativis et Animatis Corporibus in Corporibus Animatis Reperiundis Commentarius,' pars i. (Berolini: in Taberna Libraria Maureriana), p. 101.

Speiser follows Rondani in relying on the coloration of the hair on the clypeus and apex of the abdomen, and he uses these characters to distinguish what he now calls *H. dromedarina* from what he regards as the true *H. camelina*, Leach; but he also considers that the two supposed species may be distinguished by the colour of the thorax, the paler form being *H. camelina*, the darker *H. dromedarina*, Speiser. It is curious that Speiser should come to the conclusion, from the examination of Leach's original description and figure, that *camelina* was based on the pale form, since a glance at the coloured figure (in the Museum copy of Leach's paper, at any rate) is sufficient to show that it represents the dark and not the pale form. A still better argument, however, is supplied by the type itself, which is in the Museum collection and bears a label in Leach's handwriting. This specimen (a female, as indicated by Leach's figure) belongs to the dark form, but has *pale hair on the clypeus and abdomen*. According to Speiser, the true *H. camelina*, Leach, is pale brown in colour, with pale hair on clypeus and apex of abdomen; while what he calls *H. dromedarina* is dark blackish brown, with black hair on the clypeus, and on the abdomen black hairs mingled with the pale ones. A series of specimens in the Museum collection, from Algeria (*Rev. A. E. Eaton*), with one exception agree with the type in belonging essentially to the dark form, although the hair on clypeus and abdomen is pale. The specimen which constitutes the exception also has the ground-colour of the thorax dark, but the clypeus is fringed with black instead of with pale hair, and the apex of the abdomen is clothed with hair which is black at the base instead of entirely pale; it may be added that this specimen was bred and is accompanied by its puparium. In two females from Shaik Othman, near Aden, Arabia, 4. iii. 1895 (*Lieut.-Col. Yerbury*), which belong to the dark form, the hair fringing the clypeus is certainly dark brown at the base, but that on the abdomen is as light-coloured as in the pale form; on the other hand, in a male from Arabia (*J. K. Lord*) belonging to the dark form the hair on clypeus as well as abdomen is entirely pale. It is to be hoped that enough has now been said to show that we are here dealing with but a single species, which is variable as regards the ground-colour of the thorax, and sometimes as regards the colour of the hair on the clypeus and abdomen, and that *Hippobosca dromedarina*, Speiser, like *H. bactriana*, Rond., must be considered a synonym of *H. camelina*, Leach.

The Museum collection includes a series of some thirty-three specimens of *H. camelina*, Leach, from various localities

ranging from Somaliland to Algeria and from Aden to Trebizond. We also have a female from Chaman, S. Afghanistan, 28. vii. 1880, "collected at mess, at 11.0 P.M." (*Col. Swinhoe*), so that the species constitutes a further addition to van der Wulp's South Asia catalogue.

*Hippobosca maculata*, Leach : *loc. cit.* p. 553, tab. xxvi. figs. 11-13.—This species must also be added to van der Wulp's catalogue. The Museum possesses a series of some twenty-seven examples, chiefly from various localities in India and Ceylon, but also including specimens from Arabia and Egypt, and I have recently seen a female from W. Africa (Abutshi, R. Niger). The type of the species—a female, labelled in Leach's handwriting—is also in the Museum collection.

*Hippobosca rufipes*, von Olfers : *De Vegetativis et Animatis Corporibus in Corporibus Animatis Reperiundis Commentarius*, pars i. (1816), p. 101.—In addition to a considerable number of specimens of this species from various localities in South Africa, the British Museum possesses a female from Bembe Mines, Angola, W. Africa, lat.  $7^{\circ} 22' S.$  (*J. J. Monteiro*), and a male and female from the Congo (*A. Curror*).

*Hippobosca struthionis*, Janson : in Miss E. A. Ormerod's 'Notes and Descriptions of a Few Injurious Farm and Fruit Insects of South Africa' (London : Simpkin, Marshall, & Co., 1889), p. 56, fig. 23.—This species is of peculiar interest, since it was described as parasitic on *ostriches* in Cape Colony. It is true that the typical specimen of *Hippobosca rufipes*, von Olfers, was found by Lichtenstein on an ostrich at the Cape of Good Hope, but it was suggested by von Olfers that the true host may have been the quagga, which was frequently to be met with among the ostrich-flocks (*cf.* von Olfers, *loc. cit.*). In the case of *H. struthionis*, however, the flies were stated to be in "thousands" on ostriches at Mount Stewart, Cape Colony, in May 1886, and to have increased in numbers to such an extent in the two preceding years as to render it probable that the ostrich-feather industry might suffer owing to the irritation to the birds caused by the flies (*cf.* Ormerod, *op. cit.* p. 58). Whether *Hippobosca struthionis* is still a pest on South-African ostrich-farms I am not aware, but that the species is not confined to South Africa is shown by the fact that we have recently received a series of specimens from British East Africa, viz. : two males and two females from Makumbu and Athi-ya-Mawe, Feb.-May 1899 (*C. S. Belton*) ; and a female from Ukamba, Machakos

(*Capt. R. Crawshaw*). Janson's figure of *H. struthionis* is of no value for purposes of determination, but since the typical specimen is now in the British Museum I have been able to determine the material from East Africa with certainty. *Hippobosca struthionis* is a well-marked species, which cannot be confused with any other known to me: the yellow markings on thorax and scutellum are sharply defined against a dark-brown ground. The East-African specimens show two small lateral yellow dots on the scutellum, one on each side of the median fleck; these lateral spots are wanting in the type, but it is impossible to consider the East-African specimens as belonging to a distinct species, especially since the lateral spots vary greatly in size in different individuals. In one or two of our specimens they are extremely small, and thus their absence altogether is doubtless merely due to individual variation.

*Hippobosca tasmanica*, Wesché: *Ann. & Mag. Nat. Hist.* ser. 7, vol. xi. no. 64 (April 1903), p. 385, figs. 1-4 p. 384.—This species, of which, through the courtesy of Mr. Wesché, the type and two other specimens are now in the Museum collection, belongs to the genus *Ortholfersia*, Speiser (*Zeitschr. f. syst. Hymenopt. u. Dipt.*, ii. Jahrg. Heft 3 (1 May, 1902), p. 152—typical species, *Ortholfersia phaneroneura*, Speiser, *loc. cit.*, from New South Wales. *Ortholfersia tasmanica* is said to swarm on diseased wallabies (*Macropus ruficollis*) near Launceston, Tasmania.

In the 'Agricultural Gazette of New South Wales' for Dec. 1900, pp. 1090-1091, W. W. Froggatt describes, under the name of "the wallaby fly (*Olfersia Macleayi*, Leach)," a fly which is said to infest all the wallabies in the district of Port Macquarie, New South Wales. It is stated that "in the Australian Museum there are specimens taken upon *Halmaturus* [*Macropus*] *ruficollis* and *H. Perryi*." The fly is figured in a plate (figs. 3 & 4), and it is evident that it belongs to the genus *Ornithomyia*. The species was subsequently described by Speiser (*Termés. Füz.* xxv. (1902), p. 331) under the name *Ornithomyia perfuga*. The existence of *Hippobosca struthionis*, Jans., upon a bird is thus paralleled by the occurrence of an *Ornithomyia* upon mammals.

#### LIPOPTENA, Nitzsch.

*Lipoptena cervi*, L.—The British Museum has just received a specimen of this species from Modderfontein Factory, 14 miles south of Johannesburg, Transvaal. The insect (a male which has cast its wings) was taken, with others of the same



species, in February 1901, by Mr. P. S. Stammwitz on himself, after carrying with him on his horse a dead "Duikerbok" (? *Cephalophus* sp.), which he had shot. The occurrence of the European *Lipoptena cervi* in South Africa is certainly remarkable, but having carefully compared this specimen with others (presented by the late J. C. Mansel-Pleydell) from Whatcombe, Dorsetshire, from roe-deer, I am satisfied as to its specific identity. Of course, it is possible that the *Lipoptena* may originally have come from a horse, and not from the Duiker. At the time referred to, Mr. Stammwitz was serving in the South-African Constabulary, and the horse that he was riding when carrying the Duiker was an "Argentine," so that it is scarcely likely that the *Lipoptena* came from this particular horse. But it is conceivable that some time during the late South-African Campaign these flies or their parents may have been introduced with remounts from Europe. Although normally parasitic on roe- and red-deer and on elk \*, *Lipoptena cervi* sometimes strays on to horses. The Museum collection includes a specimen from Whatcombe, Blandford, Dorset (*J. C. Mansel-Pleydell*), which was "taken from a horse after passing through hazel-bushes" in a wood frequented by roe-deer, on Oct. 17, 1895. As we know, various species of *Hippobosca* are capable of existing on more than one species of host, and it is just possible that specimens of *Lipoptena* that have strayed on to horses may afterwards be carried with them to other countries. If this explanation is not the true one in the present case, it may be suggested as an alternative hypothesis that *Lipoptena cervi* has been a parasite of African antelopes as well as of European deer since the Tertiary period, when, as is well known, direct land-connection existed at various times between Europe and Northern Africa.

In addition to *Lipoptena cervi*, the Museum collection includes two specimens of a distinct and much smaller species which is as yet undetermined, from Orizaba, Mexico (*Sallé*).

#### ORNITHOMYIA, Latr.

*Ornithomyia avicularia*, L.—*Ornithomyia remota*, Walk. (List Dipt. iv. (1849), p. 1144), from Tristan d'Acunha, and *O. opposita*, Walk. (*ibid.* p. 1145), from New Zealand, are synonyms of *O. avicularia*, Linn. *Feronia Macleayi*, Leach (*loc. cit.* p. 558), is also in all probability a synonym of *O.*

\* Cf. J. P. E. F. Stein, "Zur Naturgeschichte der Lausfliege, *Lipoptena cervi*, Nitzsch," Deutsche entomologische Zeitschrift, Jahrg. xxi. (1877), pp. 297–298.

*avicularia*; at any rate, the specimen called by Walker (List Dipt. iv. p. 1141) *Olfersia Macleayi* belongs to this species.

*Ornithomyia avicularia*, van der Wulp (*nec* Linn.: Biol. Centr.-Amer., Diptera, vol. ii. (April 1903), p. 431), is in reality very distinct from *O. avicularia*, Linn., and belongs to *Ornithomyia varipes*, Walk. (List Dipt. iv. (1849), p. 1146), the type of which is from Colombia (*Goudot*). Other specimens of *O. varipes* in the British Museum collection are: a female from Huamachuca, Peru, 3000 metres, Nov. 1899 (*Simon*); a second female from Orizaba, Mexico (*Sallé*); and a third from the mountains of Molokai I., Sandwich Is., 3000 ft., 12. v. 1893 (*Perkins*). The latter is the specimen mentioned by Speiser ('Fauna Hawaiensis,' Diptera, Supplement, p. 89).

In 'Természetrájsi Füzetek,' vol. xxv. (1902), pp. 327-331, Dr. Speiser divides the genus *Ornithomyia* into three genera, viz.: *Ornithomyia*, Latr., *sens. strict.* (typical species *Hippobosca avicularia*, Linn.); *Ornithoctona*, gen. nov. (typical species *Ornithomyia erythrocephala*, Leach); and *Ornitheza*, gen. nov. (typical species *Ornithomyia Gestroi*, Rond.). *O. varipes*, Walk., would appear to belong to *Ornitheza*; nevertheless *Ornithomyia obscurata*, Walk. (Journ. Proc. Linn. Soc. v. p. 270), from Tondano, Celebes (*A. R. Wallace*), which, in spite of the great difference in locality, appears to me to be probably identical with *O. varipes*, Walk., is assigned by Speiser (*loc. cit.* p. 329) to *Ornithoctona*.

*Ornithomyia robusta*, v. d. Wulp (*op. cit.* p. 431, tab. xiii. figs. 5, 5 a, 5 b, 5 c) = *O. (Ornithoctona) erythrocephala*, Leach. The shape of the antennary processes is better represented in the coloured figure (5) than in the outline drawing (5 a). The five specimens are all females, and not as stated by van der Wulp.

*Ornithomyia pilosula*, v. d. Wulp: *op. cit.* p. 432, tab. xiii. figs. 6, 6 a.—This species closely resembles *O. varipes*, Walk., in size and general appearance. The antennary processes, however, although large and lanceolate, are narrower than in that species, more elongate, and more pointed at the tips. Their apical halves are somewhat divergent, and the species should probably be assigned to the genus *Ornitheza*, Speiser. It is stated by van der Wulp that *O. pilosula* "agrees in most respects with the European *O. avicularia*"; but the shape of the antennary processes is entirely different. The figure of the head (tab. xiii. fig. 6) is misleading, since it gives no idea of the true shape of the orbital margins, which, like those of *O. varipes*, are greatly expanded posteriorly.

*Ornithomyia batchianica*, Walk. (Journ. Proc. Linn. Soc. v. p. 300), from Batchian, = *O. (Ornithoctona) nigricans*, Leach (*op. cit.* p. 558, tab. xxvii. figs. 7-10).

*Ornithomyia (Ornithoctona) erythrocephala*, Leach : *op. cit.* p. 559, tab. xxvii. figs. 4-6.—The type of this species, bearing a label in Leach's handwriting, is in the Museum collection.

#### ORNITHOICA, Rond.

*Cf.* Speiser, Ann. Mus. Civ. Genov. ser. 2, vol. xx. (1899), pp. 555.—For synopsis of species, see Speiser, *ibid.* pp. 558-559, and Természetráji Füzetek, vol. xxv. (1902), p. 332.

*Ornithomyia vicina*, Walk. (List Dipt. iv. p. 1144), from Jamaica, on *Ephialtes grammicus* and *Psittacus leucocephalus*, belongs to this genus, and may be identical with *O. (Ornithomyia) confluenta*, Say.

*Ornithoica beccariina*, Rond. (Ann. Mus. Civ. Genov. xii. (1878), p. 160), the type of the genus *Ornithoica*, from Amboyna, on *Ardea alba*, is identical with *O. (Ornithomyia) exilis*, Walk. (Journ. Proc. Linn. Soc. v. (1861), p. 254), from Dorey, New Guinea. In spite of the great difference in locality, *O. exilis* is possibly identical with *O. vicina*, Walk.; if so, the latter name has priority. It has just been pointed out, however, that *O. vicina*, Walk., perhaps = *O. confluenta*, Say, in which case *O. beccariina*, Rond., and *O. exilis*, Walk., are also synonyms of *O. confluenta*, Say. My knowledge of this group is unfortunately insufficient to enable me to decide this question, and all I can say is that after carefully comparing our specimens of *O. confluenta*, *vicina*, and *exilis*, I have been unable to discover any characters which would warrant a positive assertion of their distinctness.

#### ORNITHOPHILA, Rond.

*Ornithomyia simplex*, Walk. (Journ. Proc. Linn. Soc. v. p. 263), from Menado, Celebes (*A. R. Wallace*), belongs to this genus; as also does an undetermined specimen from Natal (*Gueinzus*), and another, with unusually long palpi, from Port Molle, Queensland (H.M.S. 'Rattlesnake'; collected by *Macgillivray*), from *Tallegalla Lathamii*.

#### STILBOMETOPA, Coquillett.

This genus was founded (Canad. Ent. xxxi. (1899), p. 336) for *Ornithomyia fulvifrons*, Walk. (List Dipt. iv. p. 1145), from Jamaica, of which, including the type, we have five

specimens, from the following hosts: *Ortyx virginiana*, *Saurolthera vetula*, *Geotrygon sylvatica*, *G. montana*, and *Tityra leuconotus*.

A single female from St. Domingo (*Tweedie*) belongs to a distinct species, which I have not as yet determined.

According to Speiser (Zeitschr. f. syst. Hymenopt. u. Dipt. ii. Jahrg. Heft 3 (1 May, 1902), p. 163), *Olfersia impressa*, Bigot (Ann. Soc. Ent. Fr. 1885, p. 237), from California, belongs to this genus.

### OLFERSIA, Wied.

The type of *Feronia americana*, Leach (*op. cit.* p. 557, tab. xxvii. figs. 1-3), which has been adopted as the typical species of this genus, is in the Museum collection, and bears a label in Leach's handwriting.

*Ornithomyia plana*, Walk. (Journ. Proc. Linn. Soc. v. p. 254), from Dorey, New Guinea, is an *Olfersia*.

*Ornithomyia intertropica*, Walk. (List Dipt. iv. (1849), p. 1144), is also an *Olfersia*. The type of this species was obtained (with three other specimens) by Charles Darwin in the Galapagos Is.; the other examples of *O. intertropica* contained in the Museum collection include one male and two females from Honolulu, Sandwich Is. (*H. Pease*), "from the ear of an owl"; a female from Orizaba, Mexico (*Sallé*); and two females from Bahia, Brazil.

*Olfersia acarta*, Speiser (Zeitschr. f. syst. Hym. u. Dipt., ii. Jahrg. Heft 3, p. 149; see also Fauna Hawaiiensis, Diptera, Supplement, p. 87), appears to me, after comparing three of the specimens obtained by Perkins on short-eared owls in Kona, Hawaii, which were determined by Speiser and are now in our collection, to be identical with *O. intertropica*, Walk. It may be worth while to note that the actual type of *O. acarta*, Speiser, is in the Bremen Museum (*cf.* Speiser, Zeitschr. f. syst. Hym. u. Dipt., ii. Jahrg. Heft 3, p. 151).

*Olfersia vulturis*, v. d. Wulp: *op. cit.* p. 429, tab. xiii. figs. 1, 1 a.—This species has the clypeus greatly elongated, and consequently belongs to the genus *Pseudolfersia*, Coquillett (Canad. Ent. xxxi. (1899), p. 336). The figure of the head gives no indication of the shape of the clypeus, and is quite misleading; the venation, as represented in the figure of the wing, is also incorrect in details; the posterior basal cell is complete, though the anterior basal transverse vein is,



as usual, non-chitinized immediately before joining the fourth vein.

The typical specimens are male and female.

*Olfersia coriacea*, v. d. Wulp: *op. cit.* p. 430, tab. xiii. figs. 2, 2a.—Two specimens are mentioned by the author—one from Presidio, Mexico (*Forrer*), the other from Mirandilla, Guatemala (*Champion*). The former specimen (a male) belongs to *Olfersia propinqua*, Walk. (List Dipt. iv. p. 1141 (1849)), the type of which is from Jamaica. The specimen from Mirandilla, on the other hand, which is also a male, and must be regarded as the actual type of *O. coriacea*—since it is the specimen figured, while, from internal evidence, the description appears to have been based upon it,—is a *Pseudolfersia*, Coquillett, under which genus it has been placed in the Museum collection. Van der Wulp having apparently relied upon this latter specimen in preparing his description, there is no necessity to cancel the species, which may therefore be allowed to stand as *Pseudolfersia coriacea*, v. d. Wulp. In tab. xiii. fig. 2, the drawing of the clypeus is misleading, and conveys no idea of its true length; details of the venation (fig. 2a) are also inaccurate.

The British Museum collection contains two other specimens, previously undetermined, that I have referred to the present species—a female from Orizaba, Mexico (*Sallé*), and another from the Rio Tapajos, Brazil (*W. Bates*).

*Olfersia angustifrons*, v. d. Wulp: *op. cit.* p. 430, tab. xiii. figs. 3, 3a.—This is a true *Olfersia*, belonging to the group in which the palpi are proportionately elongate. A third specimen (a gravid female) from Oajaca, Mexico (*Sallé*), is in the Museum collection.

#### PSEUDOLFERSIA, Coquillett.

*Pseudolfersia (Feronia) spinifera*, Leach: *op. cit.* p. 557, tab. xxvi. figs. 1–3.—As has been suggested by Speiser (Zeitschr. f. syst. Hym. u. Dipt., ii. Jahrg. Heft 3 (1 May, 1902), p. 147), *Ornithomyia unicolor*, Walk. (List Dipt. iv. p. 1144), from Jamaica, is a synonym of this species. According to Walker (*loc. cit.*), the type of *O. unicolor* and a second specimen from Jamaica were found on *Ephialtes grammicus* and on *Fregata aquila*. Our other specimens of *Pseudolfersia spinifera* include a male from Pará, Brazil, 23.iv.1899 (*W. A. Churchill*), from *Catharistes urubu*; a female from Ascension (*T. Conry*); a female from Little Aden, Arabia, 6. iv. 1895 (*Lt.-Col. Yerbury*), “taken on a booby”

(*Sula fiber*); two males from Abd-el-Kuri, near Socotra, 23. ii. 1899 (*W. R. Ogilvie Grant*), "from *Sula sula*"; two males from Christmas I. (*H.M.S. 'Flying-Fish'*); one male and two females from Adele I., N.W. Australia, 2. v. 1891 (*J. J. Walker, R.N.*).

For remarks on the association of this species with the frigate-bird (*Fregata aquila*, L.) and its wide distribution, see Speiser, *Zeitschr. f. syst. Hym. u. Dipt.*, ii. Jahrg. Heft 3 (1 May, 1902), pp. 146-147. It is stated by Speiser (*loc. cit.* p. 147) that the fly met with by Darwin on St. Paul's I., Atlantic Ocean\*, evidently belongs to this species. The two specimens obtained by Darwin on this remote islet are in the British Museum collection, and were doubtfully referred by Walker (*List Dipt.* iv. p. 1143) to *Ornithomyia* (*Hippobosca*) *nigra*, Perty (*Del. Anim. Art.* p. 190, pl. 37. fig. 15), which is in reality a *Pseudolfersia*. It seems to me that Walker's provisional determination is correct, and that Darwin's specimens really belong to *Pseudolfersia nigra*, Perty, which is very possibly merely a synonym of *Pseudolfersia spinifera*, Leach. Nevertheless, I prefer for the present to keep the two supposed species distinct, especially since Darwin's specimens, in addition to being smaller than the average size of *Ps. spinifera*, are also in bad condition.

XXIII.—On some new Genera and Species of Parasitic Hymenoptera from the Khasia Hills, Assam. By P. CAMERON.

JOPPINI.

ACHAIUS, gen. nov.

Apex of abdomen bluntly pointed; the keel on segments 1-4. Mandibles unequally toothed, the upper much larger than the lower. Clypeus not distinctly separated from the face, its apex transverse. Labrum projecting. Scutellum convex. Median segment completely areolated, its apex with an abrupt oblique slope; the areola distant from the base, large, longer than broad, extending to the top of the apical slope; it is bluntly rounded behind, its apex slightly rounded backwards. The sides of the segment bear stout, longer than broad, teeth; the spiracles linear. Legs longish,

\* Cf. Darwin's 'Journal' (ed. 1839), pp. 7-10: the geographical position of St. Paul's I., on which the booby and the noddy were the only birds found, is 0° 58' N. lat., 29° 15' W. long.

the tarsi spinose; the apex of the hinder femora reaches to the middle of the third segment. The transverse basal nervure is interstitial; the stump of a nervure on the discocubital is longer than usual. The base of the median segment is broadly obliquely depressed in the middle; it is smooth, flat, and shining, and is bordered on the top by a distinct keel.

There are two lateral areae on the base of the median segment; the spiracular area is bounded by a not very distinct keel. The second abdominal segment is striated.

Belongs to the Joppini, and comes near to *Trogus*. I unfortunately only know the male.

*Achais flavo-balteatus*, sp. n.

Black; the greater part of the head, the edge of the pronotum, a mark in the middle of the mesonotum, the scutellums, tegulae, the areola and posterior median areae on the metanotum, the lower part of the propleurae (broadly behind, narrowly in front), a large mark (irregularly narrowed behind) on the lower half of the mesopleurae at the base, an oblique mark under the hind wings, and a large mark on the base of the metapleurae (extending beyond the middle) lemon-yellow. Legs yellow, the lower part and sides of the hinder coxae, the hinder trochanters, the base and apex of femora, and apex of tibiae, black. Abdomen black; the apices of the first and second segments, two large marks on the apex of the third, two smaller ones on the apex of the fourth, the ventral keel, and the apices of the second and third ventral segments, lemon-yellow. Wings violaceous hyaline, the stigma and nervures black. ♂.

Length 17 mm.

*Hab.* Khasia. Coll. Rothney.

Antennae black; the scape yellow below; the flagellum yellowish beneath and for the greater part above to near the middle. Front and vertex broadly in the middle, the occiput, and the upper half of the outer orbits, black. Face and clypeus closely and rather strongly punctured all over and covered with short white pubescence; the ocellar region and the upper part of the front in the middle are stoutly obliquely striated. Mandibles black, the base obscure yellow. Palpi lemon-yellow. Mesonotum closely punctured all over. Pleurae closely punctured, the apex of the propleurae striated; the mesopleurae striated in the middle and stoutly crenulated behind; the apex of the metapleurae stoutly rugose; the lower part smooth and projecting into a keel. Petiole above

closely transversely striated, the postpetiole with the sides obscurely punctured. Gastrocœli and base of second segment longitudinally striated.

*Amblyjoppa rufocincta*, sp. n.

Black; the scape of the antennæ beneath and the ninth to fifteenth joints white; the face, clypeus, labrum, a triangular mark on the base of the mandibles, the inner and outer orbits below to the mandibles, a line on the pronotum, a transverse one on its base, two short lines on the apex of the mesonotum (sharply narrowed at the base), the scutellums, two marks (narrowed gradually towards the apex and occupying the apical two thirds of the areæ on the metanotum), the tubercles, the greater part of the lower half of the mesopleuræ (the mark widely but not deeply incised at the tip), and two large marks on the apex of the petiole, yellow. Wings fusco-violaceous, paler on the basal half. Legs black, the hinder red; the four front coxæ and trochanters yellow. The second and third segments of the abdomen red. ♀.

Length 25 mm.

*Hab.* Khasia. Coll. Rothney.

Face strongly and closely punctured; the clypeus above is more sparsely and less strongly punctured; the vertex sparsely punctured. On the face is a broad black mark, narrowed above (where it is divided into three parts, a large central reaching to the top and a smaller lateral); below it extends to the clypeal foveæ. Mesonotum closely, almost rugosely punctured, the scutellum less closely punctured. Median segment rugose; areola horseshoe-shaped, irregularly closely reticulated (longitudinally in the middle, obliquely laterally); the posterior median area coarsely, irregularly, transversely striated, the striæ stout and waved; the apical half of the spiracular area is closely, stoutly, obliquely striated. Pleuræ closely punctured, the propleuræ stoutly striated at the apex and obliquely down the centre. Petiole depressed in the middle above and transversely striated; the postpetiole closely longitudinally striated in the middle, the sides sparsely, the apex in the middle rugosely punctured; the second, third, and fourth segments are closely punctured, the middle of the second longitudinally striated; the basal slope of the gastrocœli stoutly striated.

Agrees closely with *tibialis*; may be separated from it by the areola being clearly defined, by the apex of the petiole not being red, by the hinder tibiæ being red (not white), and by the scutellum only being black on the apex.



*Amblyjoppa flavo-ornata*, sp. n.

Black ; the face and clypeus (except for a triangular black mark on the former and an hourglass-shaped mark on the latter), the inner orbits to the top of the eyes, the outer narrowly below, the malar space, a triangular mark on the base of the mandibles, a broad band on the pronotum, two lines on the apex of the mesonotum, the scutellum, the apex of the prosternum, the tubercles, lower half of the mesopleuræ, and an oblique mark on the apical half of the metapleuræ, yellow. The basal three segments of the abdomen ferruginous. Legs ferruginous, the four front coxæ and trochanters, the upper part of the hinder coxæ at the base and obliquely down the middle, yellow. Fore wings uniformly fuscous violaceous, the hinder paler in tint. The tenth to twentieth joints of the antennæ white. ♀.

Length 21-22 mm.

*Hab.* Khasia. Coll. Rothney.

Face and centre of clypeus strongly but not closely punctured and sparsely covered with short white pubescence. Mesonotum closely but not strongly punctured. Scutellum sparsely punctured. Postscutellum rufous, minutely punctured between the foveæ. Areola open at the apex, which is irregularly reticulated, its inner side hollowed ; the base of the posterior median area is irregularly reticulated, the apex irregularly transversely striated. Pleuræ for the most part closely punctured. The petiole is sharply and stoutly keeled down the sides ; the postpetiole in the middle finely longitudinally striated, its apex closely punctured. The second and third segments are closely punctured, at the base closely, longitudinally striated in the middle. Gastrocœli large, deep, the base with five stout striæ.

The male is similar ; the yellow marks on the pleuræ are greatly reduced ; the hind coxæ have no yellow ; the flagellum in the middle has a brownish band.

*Amblyjoppa violaceipennis*, sp. n.

Black ; the head rufous, tinged at the sides with yellow ; a pale rufous line on the pronotum, two obscure marks on the apex of the mesonotum and two similar marks on the apex of the mesosternum, the greater part of the abdomen, and the scape of the antennæ, rufous. Legs rufous, the fore coxæ above in front, the middle entirely above, the hinder trochanters, the apex of the hinder tibiæ, and the hinder

tarsi, black; the posterior tarsi infuscated. Wings uniformly dark fuscous violaceous. ♂.

Length 22 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus strongly and closely punctured, sparsely pilose. Clypeal fovea large and deep. Labrum closely punctured. Vertex strongly punctured, the centre across the ocelli to the eyes, the lower part of the front and the upper part of the occiput, and the malar space, black. Mesonotum closely and strongly punctured; its outer edge has a bordering furrow; the scutellum not so closely punctured, especially at the apex. Median segment coarsely transversely striated. Areola flat, smooth and shining; the posterior median area coarsely transversely striated; the striae in the centre curve downwards and are more irregular than below; the supraexternal areae are sparsely punctured, smooth on the inner side, the lower closely rugosely reticulated, the spiracular closely punctured in the middle, the sides stoutly striated. Pleurae closely punctured, the metapleurae more closely than the mesopleurae; the lower part of the propleurae closely obliquely striated. Postpetiole closely and strongly punctured; the second, third, and fourth segments are closely punctured. Gastrocœli large, deep, and smooth, the part between them longitudinally striated. The second segment is entirely black above, the second and third narrowly at the base in the middle.

*Amblyjoppa varipes*, sp. n.

Black; the head (the face and clypeus lighter in tint), the mandibles (except at the apex), the mesonotum (except for a black line opposite the tegulae), the upper half of the propleurae, and a narrow line on their lower edge, rufous. The front legs entirely fulvous, slightly yellowish in front, the middle black, their coxae obscure testaceous below; the femora fulvous, lined with black below and behind; the tibiae dark fulvous in front; the hinder legs entirely black. Wings uniformly dark fuscous, with a violaceous tint; the stigma and nervures black; the tegulae rufous, the tubercles of a darker rufous colour. ♂.

Length 22 mm.

*Hab.* Khasia. Coll. Rothney.

Antennae not much longer than the abdomen, black, the scape rufous beneath; the apical joints serrate. Face and clypeus strongly but not very closely punctured, the clypeus thickly covered with long pale fulvous hair. Mandibles

thickly covered with pale fuscous hair. Mesonotum closely and uniformly punctured and thickly covered with short pubescence. Scutellum closely punctured, its apex broadly projecting and slightly incised in the middle. Pleuræ closely punctured; the hollowed centre of the propleuræ bears six perpendicular distinctly separated keels. Median segment rugosely punctured; the areola is much wider than long, is rounded behind, and almost transverse in front; its base and apex aciculated, the centre irregularly rugose, and with three irregular hollows; the posterior median area coarsely transversely striated; the spiracular rugose, its apical half with some stout oblique keels. The curved keel below the middle of the metapleuræ is stout and is furrowed below, the furrow being indistinctly crenulated. The postpetiole is strongly punctured, the second, third, and fourth segments are strongly and closely punctured. Gastrocelli deep, the middle behind with a broad striated band.

*Amblyjoppa tibialis*, sp. n.

Black; the ninth to thirteenth joints of the antennæ white; the inner orbits broadly below, more narrowly above, the outer from shortly above the middle of the eyes, narrow above, becoming gradually wider below, the labrum, the sides of the clypeus, an oblique yellow mark on the upperside of the mandibles at the base, the palpi, a line on the pronotum, roundly and broadly incised on the lower side, two small lines behind the middle of the mesonotum, the scutellar keels broadly, the apex of the scutellum (the mark with a triangular incision at the base), the postscutellum, two marks on the apex of the metanotum covering the spines, the tubercles, an irregular rounded mark on the lower side of the mesopleuræ (extending on to the propleuræ), pale yellow. Mesonotum closely and distinctly punctured; the scutellum not quite so closely punctured, its basal half with short, the apical with longer, pale hair. Areola irregularly reticulated, surrounded by a flat, broad, smooth keel, which is widened at the base; the posterior median area transversely irregularly striated, much more coarsely at the base than at the apex; the outer areae have a few stout curved keels. Pro- and mesopleuræ closely punctured, the former stoutly obliquely striated in the middle; the metapleuræ closely rugose, the punctures running into reticulations; the part above the spiracles coarsely, obliquely, rugosely reticulated. The abdominal petiole and the second and third segments entirely rufous, the petiole for the greater part strongly punctured,

the middle of the postpetiole longitudinally striated; the second, third, and fourth segments closely punctured, the base of the second stoutly longitudinally striated in the middle. Gastrocœli large, deep, smooth. The apical three segments have a distinct bluish-violaceous tinge. The four front legs black; the coxæ, trochanters, the greater part of the fore, the apical half of the middle femora in front, and the tibiæ in front, yellowish white; the hinder legs black; the trochanters, and the basal three fourths of the tibiæ, yellowish white; the femora rufous, the base slightly, the apex more broadly black; all the legs are thickly covered with white hair; the calcaria yellowish white. Wings fuscous violaceous, paler at the base. ♀.

Length 14 mm.

*Hab.* Khasia. Coll. Rothney.

*Hadrojoppa forticornis*, sp. n.

Black; the upper inner orbits to the end of the eyes, the lower half of the outer (narrowly above, broadly below), the face (except for an interrupted black line in the middle), the clypeus (except for a somewhat triangular black mark in the centre), a line on the pronotum, two short lines in the middle of the mesonotum, the scutellums, two irregular marks on the median segment on the sides in the centre, the tubercles, the lower half of the mesopleuræ, an irregular mark on the metapleuræ, and the apex of the petiole, yellow. Legs pallid yellow, the femora (except for a line in front of the middle), the hinder at the base and more broadly at the apex, the front tibiæ behind, the middle at the apex behind, the apex of the hinder tibiæ, and the apices of the tarsal joints, black. Wings yellowish hyaline, their apex broadly fuscous violaceous. Antennæ with the ninth to eighteenth joints white, the scape thickly covered with short fuscous hair, closely punctured, and with a narrow yellowish line in the middle beneath. ♀.

Length 27 mm.

*Hab.* Darjeeling and Khasia. Coll. Rothney.

Face closely, the clypeus more sparsely punctured and thickly covered with white hair; the lower part of the ocellar region and the upper part of the front strongly and distinctly punctured; the front raised, furrowed down the centre, the sides of the raised part transversely punctured, but not very closely or distinctly. Mandibles black, yellow at the base; the palpi yellow. Mesonotum closely, uniformly, and rather strongly punctured; the scutellum is less closely punctured.



The areola has a stout, flat, smooth bordering keel all round, the posterior part wider than the rest; it is roundly narrowed behind, being there only one half the width of the base, and is transverse; it is distinctly longer than wide, inside it is coarsely irregularly aciculated; the posterior median area is coarsely transversely rugose; the lateral basal area are coarsely punctured, the others coarsely rugose. Pleuræ punctured, the mesopleuræ more strongly than the rest and the meta- more strongly than the propleuræ.

May be known from *H. annulitarsis* by the first abdominal segment only being marked with yellow, by the stronger more robust antennæ, by the larger areola (which is not marked with yellow), by the yellow marks on the metanotum being smaller and by those on the metapleuræ larger.

[To be continued.]

XXIV.—*Notes on Blattidæ &c., with Descriptions of new Genera and Species in the Collection of the British Museum, South Kensington.*—No. II. By W. F. KIRBY, F.L.S., F.E.S.

Two large genera of Blattidæ are greatly in need of subdivision—*Phyllodromia* and *Epilampra*. I have not touched the former, but have detached several sections from the latter which appear to be sufficiently distinct to rank as genera, and some of these will perhaps admit of further subdivision when we have more species to classify.

BLATTIDÆ.

*PHYLLODROMINÆ.*

Genus PSEUDOMOPS, Gerv.

*Pseudomops Walkeri*, n. n.

*Pseudomops flavipes*, Walk. Cat. Blatt. B. M. p. 79. n. 10 (1868).

Differs from *P. flavipes*, Burm., in the presence of two broad parallel black stripes occupying most of the reddish part of the front of the pronotum, and connected behind by a broad blackish crescent, separated from the border of the pronotum by a narrow space. Also allied to *P. inclusa*, Walk., but the pronotum of the latter has two slender parallel blackish

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stripes, connected below into a U shape, and throwing out a short branch on each side at the lower extremity.

*Hab.* Tejuca, Brazil (*Rev. H. Clark*).

### Genus DURYODANA, nov.

Allied to *Allacta*, Sauss. & Zehntner, but easily distinguished by the very large palpi, with the second and third joints greatly dilated.

Type *Blatta palpalis*, Walk. (*Phyllodromia palpata*, Brunn.), from Borneo.

### *EPILAMPRINÆ.*

### Genus MOLYTRIA, Stål.

#### *Molytria imperatrix*, sp. n.

Long. corp. 55 millim.; exp. tegm. 118 millim.; lat. 19 millim.

*Female*.—Head yellowish grey, vertex with three parallel light brown lines; labrum with a brown band at base, followed by two brown dots; pronotum much broader than long, the lateral extremities obtusely rounded, and the hinder extremity with a slight obtusely rounded projection in the middle; pronotum and tegmina shining yellowish grey, the pronotum rather darker and edged by a paler yellow line; in the middle is a large irregularly subquadrate scutcheon, broadest and subangulated in front, and throwing out a broad obtusely rounded projection in front; the sides slope to the hinder extremity, the angles of which are rounded off; the colour is black, obsoletely and narrowly edged outside with reddish yellow; in the middle is a dull red line, and the centre on each side of this is varied with dull red and with black markings. Tegmina obsoletely shaded with brownish, and with broad yellow nervures, bordered with slender blackish lines formed of continuous dots, and with some larger blackish or pale brown spots; anal area of the left tegmen thickly punctured in rows between the numerous parallel nervures; right tegmen with the covered part brown, varied with irregular pale markings, and shading outwards into the pale ground-colour of the tegmen. Wings smoky subhyaline, darkest at the base and along the costa to the apex. Abdomen brown, darkest towards the extremity, and with a few short longitudinal carinæ, the base paler, especially at the

incisions; terminal laminae and lateral angles of the segments conspicuously pale. Antennæ, legs above, and spines reddish brown; under surface of body and legs (except spines) pale yellowish.

*Hab.* Tonkin (*Fruhstorfer*).

Allied to *M. amplipennis*, Walk., from Silhet, but much larger, and easily distinguished by the markings of the pronotum. A difficult insect to describe.

*Molytria Shelfordi*, n. n.

|| *Epilampra polypspila*, Walk. Cat. Blatt. B. M., Suppl. p. 133 (1869), nec Cat. Blatt. p. 197 (1868), which is synonymous with *M. maculata*, Brunn.

In the Oxford Museum from Sarawak, from the Saunders collection (type of *polypspila*, Walk., 1869), and in the British Museum from the same locality (*Shelford*).

Genus HOMALOPTERYX, Brunn.

*Homalopteryx Templetonii*, n. n.

|| *Epilampra cribricollis*, var. (?), Walk. Cat. Blatt. B. M. p. 195 (1868).

*Hab.* Ceylon (*Templeton*).

A very distinct species from *Epilampra lucida*, Burm. (*cribricollis*, Serv.), from Java, Borneo, &c., and without the large and conspicuous punctures on the pronotum which gave rise to Serville's name.

Genus CALOLAMPRA, Sauss.

*Calolampra Tepperi*, n. n.

|| *Epilampra propria*, Tepp. Trans. Roy. Soc. S. Australia, xvii. p. 64 (1893).

*Hab.* Kangaroo Island, South Australia.

The types of Walker's *Polyzosteria propria* are ordinary females of *Calolampra irrorata*, Fabr. (= *gracilis*, Brunn., = *atomifera*, Walk., and probably also = *fornicata*, Sauss.), and therefore the species described by Teppel requires another name. *Epilampra*, as characterized and understood by Teppel, = *Calolampra*.

Genus PSEUDOPHORASPIS, nov.

Pronotum rhomboidal, arched, covering the vertex. Tegmina about twice as long as broad, smooth and shining as if

polished, broadly and obtusely rounded at the extremity; nervures of the tegmina well marked, especially in the costal cell; anal area reticulated.

Will include *Epilampra nebulosa*, Burm., type (= *jaspidea*, Brunn.), *scita*, *congrua*, and *deplanata*, Walk., and perhaps also *conformis*, Walk., the type of which is missing.

#### Genus RHABDOBLATTA, nov.

Pronotum elliptical, broader than long, nearly concealing the head; tegmina densely reticulated, the costal area with numerous slightly oblique transverse nervures, the outer ones bifurcated; costa strongly arched, apex produced into a strong but short projecting angle, below which the hind margin forms first a shallow concavity, and then a long narrow convexity, which passes gradually into the inner margin.

Type *Epilampra præcipua*, Walk., from Ceylon.

#### Genus HETEROLAMPRA, nov.

Pronotum rhomboidal or elliptical, leaving the head more or less uncovered and often entirely free; tegmina twice or thrice as long as broad, and often more, the costal cell always with more or less distinct transverse nervures, at least towards the extremity.

*Epilampra dilatata*, Brunn. (= *laticollis*, Walk.), from Australia, being an easily recognizable species, may be indicated as the type.

This genus will require further subdivision, and has therefore been provisionally characterized in a somewhat elastic manner. For the present it is proposed to include in it all the Old-World species described under *Epilampra*, and not yet separated under other names.

Burmeister's name *Epilampra* may be retained for the American species, with *E. brasiliensis*, Fabr., as the type. They differ from the Old-World species in the usually rather small costal cell of the tegmina never containing transverse nervures, even towards the extremity, nor are any visible in the large species separated by Stål as *Pæciloderrhis* (type *verticalis*, Burm.).

#### *Heterolampra puncticollis*, Walk.

*Epilampra puncticollis*, Walk. Cat. Blatt. B. M. p. 74. n. 28 (1868).

*Hab.* Sarawak.



*Heterolampra Stæli*, n. n.

|| *Epilampra puncticollis*, Stål, Œfv. Vet.-Akad. Förh. xxxiv. (10) p. 34 (1877).

*Hab.* Philippines.

*Heterolampra Saussurei*, n. n.

|| *Epilampra puncticollis*, Sauss. Rev. Suisse Zool. iii. p. 359 (1895).

*Hab.* China.

*Heterolampra monticola*, sp. n.

Long. corp. 25–27 millim.; exp. al. 71 millim.

*Female*.—Head prominent, pale yellowish grey below the antennæ; above thickly punctured with black. Pronotum yellowish grey, with traces of a more yellow longitudinal line, very broad behind; lateral borders subhyaline. The whole surface crowded with small brown or black, sometimes confluent, punctures; a row of short black streaks on the hinder border, a row of small black dots near the lateral margins, and a few larger scattered ones nearer the centre. The rest of the upper surface liver-coloured, but darkening into blackish towards the extremity of the abdomen; abdomen with 4 oblong pale spots at the base of each segment, and a few small raised carinæ towards the extremity of some of the hinder ones; terminal laminæ and lateral angles of the segments pale, setæ reddish, with a black line above. Under surface pale yellowish grey, tips of spines and claws darker; a row of black dots towards the end of each segment of the abdomen. Tegmina pale yellowish grey, with a number of scattered blackish dots in the costal cell, which is small and rather indistinctly veined, and 8 or 10 brown blotches on various parts of the tegmina, the 5 or 6 largest being beyond the middle. Covered part of the right tegmen separated by a broad, whitish, oblique streak, ceasing at about two thirds of the distance to the costa. Wings subhyaline, with pale nervures, more or less yellowish, and dotted with black towards the costa.

*Hab.* Matton Mountains, Tonkin, April and May (*Fruhstorfer*).

Resembles *H. lucida*, Burm., in shape, but the pronotum is narrower and much more closely punctured. Received under the name of *parvicollis*; but *Epilampra parvicollis*, Walk., is a species of *Hedaia*.

*Heterolampra pallida*, sp. n.

Long. corp. 37 millim.; exp. al. 77 millim.

*Female*.—Very similar to the last species, of which I thought at first it might be a variety; but the head, pronotum, and tegmina of a much paler and more uniform grey. Head and pronotum very thickly marked with black punctures, clearly defined, though showing a tendency to run together into groups; pronotum with a few larger black dots, chiefly towards the hinder extremity. Tegmina with the principal nervure marked with black on the basal third of the tegmen; costal area pale, somewhat more distinctly veined than in the last species; tegmina not otherwise spotted, but the covered part of the right tegmen brownish below the rather indistinct oblique whitish streak. Wings brownish hyaline, darkest towards the costa, with a clearer hyaline space towards the tip. Abdomen dark brown, lighter towards the base of the segments, and with numerous short, raised, blackish carinæ towards their extremity. Terminal laminæ pale. Under surface grey; legs more yellowish; abdomen beneath with rather indistinct black dots towards the extremity of each segment, and a row of large black spots on each side.

*Hab.* Tonkin (same remarks as last species).

*Heterolampra Ridleyi*, sp. n.

Long. corp. 47 millim.; exp. al. 116 millim.

*Female*.—Head brownish chestnut above, passing into yellowish tawny below; antennal pits slightly bordered with brown in front; pronotum leaving the head only slightly free, elliptical, much broader than long, the lateral angles only slightly rounded, reddish brown, rather darker in the middle, but not towards the extremity, with numerous shallow black punctures, and a few rather larger black dots, chiefly towards the hinder extremity; front with slight transverse ridges in the middle; meso- and metanotum yellowish brown (perhaps discoloured); abdomen very broad, orange tawny, with a slight central carina, and slight raised concolorous carinæ at the extremities of the segments; terminal laminæ very long, brown, except at the base. Tegmina light grey, with numerous pale spots and spaces, largest and most numerous towards the tips; costa arched, covered part of right tegmen yellowish brown beyond the pale yellowish oblique line. Wings smoky brown along the costa, this colour extending towards the tip as far as the fold; between this and the base

is a long, narrow, triangular, yellowish space; apex and the whole of the wings below the fold subhyaline. Under surface of body reddish brown, shading into black towards the extremity of the abdomen; pleura and front coxæ slightly pruinose-grey; legs blackish above, reddish brown below.

*Hab.* Singapore.

One of the largest species of the Epilamprinæ, and not closely allied to any other. I am glad to have the opportunity of naming this conspicuous insect after Mr. H. N. Ridley, to whom the Museum is indebted for so many valuable specimens.

Genus HEDAIA, Sauss.

*Hedaia abdominalis*, sp. n.

Long. corp. 15 millim.; exp. al. 65 millim.

*Female*.—Head free, liver-coloured above the antennæ, with very large pale yellow ocelliform spots; mostly pale yellow below the antennæ. Pronotum rather small, moderately produced behind; pale yellow, darker in the middle, very thickly speckled with brown, and with a few larger and more distinct black dots, especially along the front border. Abdomen yellowish tawny. Under surface with a rather broad black median stripe. Tegmina rather long and narrow, with the apex rounded off, brown, speckled with yellow, and with several larger yellow (sometimes whitish) spots. Wings brown along the costal area, brownish hyaline below.

*Hab.* Tonkin.

Allied to *H. olivacea*, Sauss., from Cochin China, but differs in the colour of the abdomen &c.

*Hedaia immaculata*, sp. n.

Long. corp. 35 millim.; exp. al. 74 millim.

*Female*.—Head free, black, ocellar spots large, pale yellow, and mouth-parts below the clypeus yellowish at the sides, darker in the middle. Pronotum black, finely transversely striated, the sides towards the borders slightly subhyaline reddish in front; two slight impressions near the middle. Tegmina rather long and narrow, brown, rather paler towards the extremities, where they are obtusely rounded off. Wings as in *H. abdominalis*. Abdomen and underside yellowish tawny; legs blackish above.

*Hab.* Tonkin, Matton Mountains, April or May (*H. Fruhstorfer*).

Allied to *H. olivacea* and *H. abdominalis*.

*Hedaia horologica*, sp. n.

Long. corp. 35 millim.; exp. al. 81 millim.

*Female*.—Head free, light reddish brown in the middle, yellowish grey behind and below the eyes, on the front of the vertex, and on the sides and lower part of the face, the dark part terminating in a short blackish transverse stripe at the base of the labrum; pronotum light tawny, the sides subhyaline grey, mottled, spotted, and punctured with black; a black hourglass-shaped spot behind the middle, the front of which is occupied by two large punctures surrounded with black about the middle of the pronotum; abdomen tawny, blackish towards the extremity of the hinder segments above, paler and granulated with black below; a row of blackish sublateral spots both above and below. Tegmina yellowish grey, mottled with light ferruginous brown; covered part of the right tegmen broadly ferruginous. Wings brownish subhyaline, with whitish cross-nervures; costal area purplish brown.

*Hab.* Khasia Hills.

Allied to *H. procera*, Brunn. (*Borrei*, Sauss.), but has more superficial resemblance to *Molytria maculata* and *Shelfordi*, from which its free head, narrow wings, &c. amply distinguish it.

[To be continued.]

XXV.—*Notes on the Natural History of East Finmark*. By Canon A. M. NORMAN, M.A., D.C.L., LL.D., F.R.S., F.L.S.

[Continued from p. 128.]

## ANNELIDA POLYCHÆTA.

PROFESSOR M'INTOSH kindly determined for me many of the Polychæta which I collected; these included several species not previously recorded from this district. The list of Polychæta has been made as far as possible complete by adding the Annelida collected by M. Sars, Esmark, Danielssen, and others in this district. I have gone through a large number of papers with care. All that was known of Norwegian Polychæta up to 1894 as regards species, though not fully with respect to habitats, will be found in Olaf Bidentkap's



“Systematisk oversigt over Norges Annulata Polychæta,” Christ. Vidensk.-Selsk. Forhandl. 1894. Dr. Armauer Hansen’s Report on the Annelids in the Norwegian North-Atlantic Expedition also gives many Annelids of East Finmark from Stats. 160, 161, and 162.

The following particulars with regard to the distribution of Annelids on the Norwegian coast are derived from Bideupkaps lists:—

1. Total number of species of Polychæta known in Norway ..	207
2. Species found on the south coast .....	118
3. Species found on the west coast up to Trondhjem .....	150
4. Species found in the Trondhjem Fjord .....	94
5. Species found in the Lofoten Islands sea .....	97
6. Species in the whole of Norway north of the Lofoten Islands.	108
7. Recorded here from East Finmark .....	80

The areas represented by these figures are very variable in size, 4, 5, and 7 being much smaller than the others; 7 is, of course, a part, and only a very small part, of 6.

Twenty years ago G. W. R. Levinsen published his “Systematisk-geografisk Oversigt over de nordiske Annulata, Gephyrea, Chætognathi og Balanoglossi” (Vidensk. Meddel. fra den naturh. Foren. i Kjöbenhavn, 1882 and 1883). Since that time additions have been made to the several faunas; but it remains the most recent summary of the annelidan fauna of the northern countries.

Denmark .....	138
Sweden .....	147
Norway .....	191
Novaja Zembla and Kara Sea .....	97
Siberia and Berings Strait .....	66
Spitsbergen .....	82
Faroe Islands.....	64
Iceland .....	71
Greenland .....	109
North-east America .....	106

Unfortunately we have no recent complete work on British Polychæta or even anything like a catalogue of the species. At the present time many British species have merely been indicated by perhaps a few lines in the midst of a paragraph. The fullest local catalogues we have are those of Dr. J. F. Gemmill of the Clyde District\*, which contains 121

\* ‘Fauna, Flora, and Geology of the Clyde Area,’ Glasgow, 1901. (Published by Local Committee of the British Association.)

species, and of Dr. M'Intosh of the fauna of St. Andrews \*, which embraces 109 species. I made a MS. list of British species a few years ago, and, adding more recently described and recorded forms, I do not think I shall be far wrong if I estimate the British Polychæta at over 260.

*Harmothoe rarispina*, M. Sars.

—— *Sarsi*, Malmgren.

—— *nodosa*, M. Sars.

—— *imbricata*, Linné. In all the fiords.

*Lepidonotus squamatus*, Linné.

—— *cirrosus*, Pallas. Lang Fiord.

*Aphrodite aculeata*, Linné.

*Lætmonice filiformis*, Kinberg.

*Leanira tetragona*, Örsted. N. N. A. Exped., St. 261.

*Eulalia viridis*, Müller. Vadsö; Lang Fiord, 2-5 fathoms.

*Phyllodoce maculata*, Müller.

*Nephtys Malmgreni*, Théel, = *M. longisetosa*, Malmgren. Bög Fiord, 100-125 fathoms.

—— *ciliata*, Müller. Klosterelv Fiord.

—— *Hombergi*, Aud. & Edw. N. N. A. Exped., Stat. 262.

*Glycera capitata* (Örsted), M. Sars. Bög Fiord, 100-125 fathoms.

—— *alba*, Rathke.

*Goniada norvegica*, Örsted. N. N. A. Exped., Stat. 261.

—— *maculata*, Örsted. See G. O. Sars, 'Bidrag til Kundskaben om Christianiafjordens Fauna,' iii. 1873, p. 30. "Vadsö."

*Lumbriconereis fragilis*, Müller. Varanger Fiord.

*Onuphis conchylega*, M. Sars. Varanger Fiord.

—— *hyperborea*, A. Hansen. Varanger Fiord, 100-125 fathoms.

*Ceratocephale Lovéni*, Malmgren.

*Nereis pelagica*, Linné. Klosterelv Fiord.

*Laodice norvegica* (Linn.), Savigny. Vadsö Harbour.

*Syllis Blomstrandi*, Malmgren.

—— *armillaris*, Örsted. Varanger Fiord.

*Ephesia gracilis*, H. Rathke. Varanger Fiord.

\* M'Intosh (W. C.), 'The Marine Invertebrates and Fishes of St. Andrews,' 1875, pp. 115-132.

- Spio cirratus*, M. Sars. Klosterelv Fiord, 3-5 fathoms.  
*Spiochætopterus typicus*, M. Sars.  
*Chætopterus norvegicus*, M. Sars.  
 \**Chaetogone setosa*, Malmgren. Svolvær, Lofoten Islands.  
*Cirratulus cirratus*, Müller. Klosterelv and Lang Fiords.  
*Scolophos armiger*, Müller. Klosterelv Fiord, 3-5 fathoms.  
*Ammotrypane aulogaster*, Rathke. Varanger Fiord.  
*Travisia Forbesi*, Johnston. Varanger Fiord.  
*Ophelia limacina*, Rathke.  
*Flabelligera affinis*, M. Sars.  
*Trophonia plumosa*, Müller.  
 — *hirsuta*, A. Hansen.  
 — *glauca*, Malmgren.  
*Brada villosa*, Rathke. Lang and Klosterelv Fiords.  
 — *granulata*, Malmgren. Lang Fiord, 15-25 fathoms.  
*Euphrosyne borealis*, Örsted.  
*Spinther arcticus*, M. Sars.  
*Scalibregma inflatum*, Rathke. Klosterelv Fiord.  
*Notomastus latericeus*, M. Sars. Svolvær, Lofoten Islands (*A. M. N.*);  
 Vadsö (*Danielssen*).  
*Arenicola marina*, Linné. Sydvaranger Fiord.  
*Olymene Mülleri*, M. Sars.  
 — *prætermissa*, Malmgren. N. N. A. Exped., Stat. 260.  
 — *gracilis*, M. Sars.  
*Nicomache lumbricalis*, Fabricius. Varanger Fiord.  
*Maldane biceps*, M. Sars.  
*Owenia assimilis*, M. Sars.  
*Pectinaria hyperborea*, Malmgren. Lang Fiord, 10-30 fathoms.  
 — *belgica*, Pallas.  
*Melinna cristata*, M. Sars.  
*Sabellides octocirrata*, M. Sars. N. N. A. Exped., Stat. 261.  
 — *borealis*, M. Sars. Klosterelv Fiord, 3-5 fathoms.  
*Amphicteis Gunneri*, M. Sars. Lang Fiord, 5-30 fathoms.  
*Leucariste albicans*, Malmgren.  
*Terebellides Strömii*, M. Sars. Klosterelv Fiord.  
*Thelepus circinnatus*, Fabricius. Varanger Fiord.  
*Amphitrite cirrata*, Müller. Varanger Fiord.  
 — *grænländica*, Malmgren.  
*Terebella debilis*, Malmgren.  
*Lecena abbranchiata*, Malmgren.

- Amphicora Fabricii*, Müller. Varanger Fiord.  
*Euchone papillosa*, M. Sars. Lang and Klosterelv Fiords.  
*Chone infundibuliformis*, Kröyer.  
*Dasychone infarcta*, Kröyer.  
*Sabella Fabricii*, Kröyer.  
*Potamilla neglecta*, M. Sars.  
 — *reniformis*, Müller.  
*Leptochone Steenstrupii*, Kröyer.  
*Filograna implexa*, Berkeley.  
*Apomatus globifer*, Lovén.  
*Potamocerus triqueter*, Mörch.  
*Placostegus tridentatus*, Fabricius.  
*Spirorbis borealis*, Linné.  
 — *spirillum*, Linné.  
 — *granulatus*, Linné.

## GEPHYREA.

## Fam. Sipunculidæ.

## Genus PHASCOLOSOMA, Leuckart.

*Phascolosoma eremita*, M. Sars.

1850. *Sipunculus eremita*, M. Sars, Mag. for Naturvid. p. 77, and Nyt Mag. f. Naturvid. 1857, p. 197.  
 1857. *Phascolosoma eremita*, Diesing, "Revision der Rhyngoden," Sitz. d. mathem.-naturw. Cl. der k. Akad. der Wiss. vol. xxxvii. p. 760.  
 1865. *Phascolosoma boreale*, Keferstein, Nachricht. d. k. Ges. d. Wiss. Göttingen, p. 206, and Zeitschr. f. wiss. Zool. vol. xv. 1865, p. 437, pl. xxxi. fig. 7, & pl. xxxiii. fig. 33.  
 1875. *Phascolosoma boreale*, Théel, Bihang till K. Svenska Vet.-Akad. Handl. vol. iii. no. 6, p. 10.  
 1877. *Phascolosoma eremita*, Koren & Danielssen, Fauna litt. Norvegiæ, pt. iii. p. 134, pl. xv. fig. 45.

Found at Vadsö and in Sydvaranger.

*Phascolosoma margaritaceum*, M. Sars.

1851. *Sipunculus margaritaceus*, M. Sars, Nyt Mag. for Naturvid. vol. vi. p. 196.  
 1865. *Phascolosoma margaritaceum*, Keferstein, Nachricht. d. k. Ges. d. Wiss. Göttingen, vol. iv. p. 201, and Zeitschr. f. wiss. Zool. p. 430, pl. xxxi. fig. 9, & pl. xxxii. figs. 28, 29.  
 1865. *Phascolosoma Ærstedii*, Keferstein, Nachricht. d. k. Ges. d. Wiss. Göttingen, p. 205, and Zeitschr. f. wiss. Zool. p. 436, pl. xxxi. fig. 8, & pl. xxxiii. fig. 39.  
 1871. *Phascolosoma Ærstedii*, Ehlers, Sitzungsber. d. phys.-med. Soc. zu Erlangen, vol. iv. p. 83.



1875. *Phascolosoma Ørstedii*, Théel, Bihang till K. Sv. Vet.-Akad. Handl. vol. iii. no. 6, p. 9.

1877. *Phascolosoma margaritaceum*, Koren & Danielssen, Fauna littoralis Norvegiæ, pt. iii. p. 135, pl. xv. figs. 43, 44.

In 100–120 fathoms, Bög Fiord.

*Phascolosoma albidum* and *Phascolosoma fulgens* of Théel are also referable to this species.

### Genus PHASCOLION, Théel.

#### *Phascolion Strombi* (Montagu).

I lump under this name a number of forms varying in size, amount of development of tubercles of the surface, &c. The genus requires more careful working out than it has hitherto received, notwithstanding the papers of Théel and others. Some of the East-Finmark specimens are referable to var. *verrucosa*, Kor. & Dan. *Phascolion* was found inhabiting tubes of *Serpula* and shells of *Trophon truncatus*, *Admete viridula*, *Pyrene rosacea*, *Bela* (species), *Machæroplax verrucosa*, *Margarita grænlandica*, young *Fusi*, *Dentalium*, *Trichotropis*, *Cylichna alba*, and *Lacuna quadrifasciata*.

### Fam. Priapulidæ.

#### Genus PRIAPULUS, Lamarck.

\**Priapulus caudatus*, Lamarck.

I dredged this species at Svolvær, Lofoten Islands, but not at East Finmark.

#### Genus PRIAPULOPSIS, Koren & Danielssen, 1875.

#### *Priapulopsis typicus*, Koren & Danielssen.

1868. *Priapulus bicaudatus*, Danielssen, Forhand. Skand. Naturforsk. tiend Möde, p. 542 (*vide* Kor. & Dan.).

1875. *Priapulopsis typicus*, Koren & Danielssen, "Bidrag til de norske Gephyreers Naturhistorie," Nyt Mag. Naturf. vol. xxi. p. 28 (separate copy).

1877. *Priapuloides typicus*, Koren & Danielssen, Fauna litt. Norvegiæ, pt. iii. p. 147, pl. xvi. figs. 10–14.

1881. *Priapuloides typicus*, Danielssen & Koren, Norwegian North-Atlantic Exped. 1876–1878, Gephyrea, p. 13, pl. iii. figs. 1–12, & p. 147.

The two type specimens described in the 'Fauna littoralis Norvegiæ' were found in the Varanger Fiord in 120 fathoms on a clay bottom. It was taken in the same district by the Norwegian North-Atlantic Expedition at Stat. 262, lat.

70° 36' N., long. 32° 35' E., in 148 fathoms. Koren and Danielssen, when they instituted *Priapuloides*, appear to have forgotten that they had previously named the genus *Priapulopsis*.

### Genus HALICRYPTUS, Siebold, 1849.

#### *Halicryptus spinulosus*, Siebold.

1849. *Halicryptus spinulosus*, Siebold, Neue preuss. Provinzialblätter, Königsberg, vol. vii. p. 184.  
 1859. *Halicryptus spinulosus*, Diesing, "Revision der Rhyngoden," Sitzb. d. mathem.-naturw. Cl. xxxvii. Bd. no. 21, p. 779.  
 1862. *Halicryptus spinulosus*, Siebold, Zeitschr. f. wiss. Zool. vol. xi. p. 413.  
 1862. *Halicryptus spinulosus*, Ehlers, Zeitschr. f. wiss. Zool. vol. xi. p. 401, pl. xxiv.  
 1870. *Halicryptus spinulosus*, Säger, "The Baltic Representatives of *Gephyrea*; *Halicryptus* and *Priapulus*," Trans. Second Congress of Russian Naturalists in Moscow, p. 207 (in Russian).  
 1871. *Halicryptus spinulosus*, Willemoës-Suhm, Zeitschr. f. wiss. Zool. vol. xxi. p. 385.  
 1871. *Halicryptus spinulosus*, Willemoës-Suhm, Ann. & Mag. Nat. Hist. ser. 4, vol. viii. p. 143.  
 1871. *Halicryptus spinulosus*, Ehlers, Sitzungsbericht d. phys.-med. Soc. zu Erlangen, vol. iii. p. 84.  
 1885. *Halicryptus spinulosus*, Apel, Beitrag zur Anat. und Histol. des *Priapulus caudatus* und des *Halicryptus spinulosus*.  
 1885. *Halicryptus spinulosus*, Scharff, "Skin and Nervous System of *Priapulus* and *Halicryptus*," Quart. Journ. Micros. Sci. n. s. vol. xxv. p. 193, pl. xiv. figs. 3, 4, 5, 11.

Not uncommon; dug between tide-marks in Klosterelv Fiord. So far as I am aware it has not previously been found in Norway. Its localities are best given by Théel as Spitsbergen and the Baltic, where it occurs not further north than Brävikén or further south than Ystad (Théel, "Etudes sur les Géphyriens inermes des Mers de la Skandinavie, du Spitsberg et du Groënland," Bihang till K. Svensk. Vet.-Akad. Handl. vol. iii. 1876, p. 24).

[To be continued.]

### BIBLIOGRAPHICAL NOTICE.

*The Flora of the Presidency of Bombay.* Part II. *Simarubaceæ* to *Leguminosæ* (*Papilionaceæ*). London: Taylor & Francis, 1902. 8vo. Pp. 193-408. 9s.—Part III. [*Leguminosæ*] *Cæsalpinea* to *Rubiaceæ*. 1903. Pp. 409-626. Indexes, pp. 627-645. Title & Preface, pp. ix. 10s. By THEODORE COOKE, C.I.E. &c. Published under the Authority of the Secretary of State for India in Council.

THERE is no occasion to repeat what has already been published in these columns (Ann. & Mag. Nat. Hist. ser. 7, vol. ix. (1902) p. 75),

inasmuch as the author has continued his work on the same lines and with the same success as in his first part. It is very pleasant to record our satisfaction that, roughly speaking, about one third of this flora is now in the hands of the public, and there is every reason to suppose that it will be finished in a reasonable time from now. It is easy to see how much the author's labours have been eased by the preliminary results achieved by Sir Joseph Hooker and his co-workers in the pioneer work, the 'Flora of British India,' but it is none the less gratifying that such good use has been made of these preliminary studies by Dr. T. Cooke.

We notice a few names make their appearance here for the first time; in Part II. these are *Vitis Woodrowi*, Stapf, and *Flemingia nilgiriensis*, Wight, with *Indigofera Dalzellii*, *Eleiotis trifoliolata*, and *Phaseolus Dalzellii*, for which the author is responsible. In Part III. we have noticed only two, they being *Kalanchoe Bhidei* and *Plectronia Wightii*.

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## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

May 27th, 1903.—Edwin Tulley Newton, Esq., F.R.S.,  
Vice-President; in the Chair.

The following communication was read:—

‘Two Toarcian Ammonites.’

By S. S. Buckman, Esq., F.G.S.

Two ammonites, belonging to the family Hildoceratidæ, found by members of the Cotteswold Naturalists' Field-Club, are described and named. The allies of both species have been figured in the 'Monograph of Inferior-Oolite Ammonites.' One is near to *Denckmannia torquata*, but the degenerative change begins at an earlier age, and it soon shows marked decline of ornament of which that species gives little information. Its date of existence is probably hemera *Variabilis*. The other is a platygyral costate degenerative of *Chartonia binodata*; the inner whorls should be the morphic representations of that species, the outer whorls show a costate stage which is the general rule of decline from a tuberculate stage. Notes are given explaining the technical terms employed.

## MISCELLANEOUS.

*A Matter of Nomenclature.* By EDGAR R. WAITE.

IN a recent paper\* I proposed the generic name *Prosoplismus* for *Histiopterus recurvirostris*, Richardson. Since the publication of this paper I have purchased some parts of Steindachner and Döderlein's "Beiträge zur Kenntniss der Fische Japan's"†.

In this work I find the name *Pentaceropsis* applied to *H. recurvirostris* and *H. labiosus*, Günther; it therefore has precedence of my name. I cannot admit an alliance of these two species; the latter should either re-enter *Histiopterus* or be made the type of a new genus, with *H. Furnelli*, Waite, as an associate, such being a name to replace *Richardsonia*, Castelnau (preoccupied).

In the absence of the actual work on the fishes of Japan, my action was unavoidable, for the genus *Pentaceropsis* was omitted from the 'Zoological Record,' though *Histiopterus*, under which it occurs, was duly noted (Zool. Rec. 1883, p. 19). It is naturally also omitted from the new 'Index Zoologicus.' This omission is responsible not only for my name *Prosoplismus*, but also for the re-application (in 1889) of *Pentaceropsis* by Sladen to a genus of Echinodermata, which cannot, of course, be maintained.

In drawing attention to the omission from the 'Zoological Record' I do not desire to attach blame to the Recorders: such is really merited by the authors—first, for naming a genus in what is practically a footnote, without distinctive heading; and, second, for introducing into a work on Japanese fishes the description of an Australian species. These two points are covered by the later recommendations proposed in the second report of the British Association Committee on Zoological Bibliography and Publication (1897). Art. 6 reads:—"That new names should not be proposed in irrelevant footnotes or anonymous paragraphs" (p. 361). *Pentaceropsis* occurs as a footnote, and is irrelevant to the title and scope of the work.

*Pentaceropsis* naturally suggests *Pentaceros*, which also occurs (p. 8) in the work cited. This name has been considered as applicable to fishes, because its earliest use, by Linck in Echinodermata (1733), is pre-Linnean. It did not appear in ichthyological literature until 1829 (Cuvier and Valenciennes), whereas Schülze used it in 1760, and thus established the name for the Asteroidea. A statement of the case will be found in Sladen's Report on the Asteroidea‡. I am not aware that any name has yet been proposed to replace *Pentaceros* in ichthyology.

Australian Museum, Sydney,  
May 26, 1903.

\* Rec. Austr. Mus. v. 1903, p. 53, pl. vi.

† Denk. Akad. Wien, xlviii. 1883, p. 13 (footnote), pl. vi.

‡ 'Challenger' Report, xxx. 1889, p. 343.



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\* \* \* It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

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# THE ANNALS

## MAGAZINE OF NATURAL HISTORY.

AND

[SEVENTH SERIES.]

No. 69. SEPTEMBER 1903.

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XXVI.—*Descriptions of Sixty-eight new Gastropoda from the Persian Gulf, Gulf of Oman, and North Arabian Sea, dredged by Mr. F. W. Townsend, of the Indo-European Telegraph Service, 1901–1903.* By JAMES COSMO MELVILL, M.A., F.L.S., F.Z.S., and ROBERT STANDEN, Assistant Keeper, Manchester Museum.

[Plates XX.–XXIII.]

Two years ago we published a Catalogue \* of the Mollusca of the Persian Gulf, &c. (Cephalopoda, Gastropoda, and Scaphopoda only), mainly collected by Mr. Townsend in 1893–1900, and enumerating 935 species. In the interim further large consignments have been frequently forwarded by the same energetic collector from many different stations and depths, including especially the results of one particularly profitable dredging on 7th April, 1903, in the Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , at 156 fathoms, which, it is no exaggeration to say, positively teems with novelties. All this has naturally delayed publication of the second portion—to contain the Pelecypoda—of the above-mentioned Catalogue.

At the present opportunity we offer descriptions of many Gastropoda, mostly of small size, though a few—e. g., *Murex*

\* Proc. Zool. Soc. 1901, vol. ii. pp. 327–460.

*Marjoriæ*, *Trichotropis pulcherrima*, and the highly sculptured and unique *Pleurotoma navarchus*—are more conspicuous. The *Scalæ*\* are enumerated elsewhere.

Amongst the “minutiora” we would call especial attention to the two new species referred to *Homalaxis*, the *H. cornu-Ammonis*, especially, being entirely evolute from the apical whorl and exactly like a microscopic “ram’s-horn.” *Cyclostrema euchilopteron*, *prominulum*, and *Emarginula undulata* are very wonderful in their sculpture. A *Fluxina*, the first recorded from the Old World, and the curious *Rissoina registomoides* are both noteworthy. So is a new species of *Melula* (*M. dophnelloides*) and many *Pleurotomidæ*, this family ever having the pre-eminence in abyssal waters. The *Kleinella sympiesta*, also near akin to *K. cancellaris* and *sulcata* of Adams, belongs to a genus which has not before been known to exist in the Arabian Sea or Persian Gulf.

To Mr. Edgar Smith, I.S.O., and Mr. E. R. Sykes we must express our best thanks for assistance, likewise to Mr. G. B. Sowerby, and Mr. W. Neville Sturt, of the India Office.

*Emarginula undulata*, sp. n. (Pl. XX. fig. 1.)

*E. testa parva, delicata, albida, oblonga, apice multum recurvo, marginem posticum fere superimpendente; radiis costalibus ad 40, majoribus cum minoribus sæpius alternantibus, posticis crassis, firmis, cæteris delicatis, undulato-crenatis, undique transversim elegantissime et arete concentrice liratis, liris undulatis, continuis; fissura angusta (in longitudine  $2\frac{1}{2}$  mm.); cicatrice fissurali vel septo conspicuo, circa 30-loculato, loculis crasse foraminatis; apertura oblonga, intus alba, margine crenulato.*

Long. 5·50, alt. 2·50, lat. 3·75 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A particularly delicate species, with wavy crenulate rays, crossed by very characteristic, concentric, close-meshed liræ, continuously covering the rays and whole surface.

*Emarginula Camilla*, sp. n. (Pl. XX. fig. 2.)

*E. testa ovato-oblonga, depresso-conica, delicata, alba, apice supra medium recurvo, superficie omnino pulchre radiata vel costulata; costulis ad 45, lævibus, nitidis, gemmato-nodulosis, majoribus cum minoribus sæpe alternantibus, liris undique spiraliter conjunctis; interstitiis quadratulis, profunde foraminatis; fissura antica angusta (in longitudine ad 2 mm.), septo inconspicuo; apertura ovato-oblonga, intus alba, margine multicrenato.*

Long. 6·50, lat. 4·50, alt. 3 mm.

\* Journ. of Conch. x. pp. 340 sqq.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

Of the same character superficially as *E. candida*, Ad., from Japan, *elongata*, Costa, &c., but differing from all in greater delicacy and fineness of sculpture.

*Cyclostrema henjamense*, sp. n. (Pl. XX. fig. 3.)

*C.* testa parva, depresso-discoidali, delicata, albidā, profunde sed anguste umbilicata; anfractibus 5, quorum duo apicales læves, mamillati, vitrei, cæteris apud suturas paullum excavatis, ultimo spiraliter septem-carinali, carinis duabus ad peripheriam quam maxime conspicuis, undique longitudinaliter arctissime et oblique costulatis, costulis supra coronulatis et gemmatis, regione umbilicari circa marginem carinata, deinde costulis longitudinalibus perspective delabentibus; apertura subrotunda, intus alba; peristomate crassiusculo, continuo.

Alt. 3, diam. 6 mm.

*Hab.* Persian Gulf, Henjam Island, 10 fathoms, amongst coarse sand and broken shells.

A little species, which appears on the borderland between *Cyclostrema* and *Liotia*, the mouth-characters being Cyclostremoid. It is a particularly attractive species, the seven keels on the last whorl being closely longitudinally intersected by oblique riblets, these being gemmulate at the points of junction.

*Cyclostrema supremum*, sp. n. (Pl. XX. fig. 4.)

*C.* testa minuta, planato-discoidali, alba, nitidula, profunde umbilicata; anfractibus 5, apud suturas excavatis, quorum duo apicales multum canaliculati, lævissimi, vitrei, cæteris depressiusculis, penultimo uni-, ultimo tricarinato, undique arctissime oblique costulato; costulis lævibus, interstitiis spiraliter tenuistriatis, costularum numero ultimum apud anfractum circa 28, infra peripheriam et circa regionem umbilicarem læviore, costulis ad basim fere evanidis; apertura oblique ovali, intus alba, labro paullum incrassato.

Alt. 1.50, diam. 4 mm.

*Hab.* Persian Gulf, near Fao. Likewise off Bunder Abbas, 5 fathoms, mud bottom.

A most exquisite species, beautifully cancellate and sculptured, though more or less smooth below the periphery and around the narrow but deep umbilicus. The whorls are all channelled at the sutures, this with a lens being very distinct at the apex.

The nearest ally is, perhaps, *C. eburneum*, Nevill (Journ. As. Soc. Bengal, xlv. part 2, p. 101, pl. viii. figs. 21, 22), which is, however, a larger shell, with coarser sculpture proportionately.

*Cyclostrema annellarium* \*, sp. n. (Pl. XX. fig. 5.)

*C. testa parva, discoidali, profunde umbilicata, supra plana, alba, solidula; anfractibus tribus, quorum ultimus magnopere aliis exsuperans, rotundatus, undique costis longitudinalibus circularibus, numero ad quinque et viginti, præditus, interstitiis pulchre striatis; apertura rotundata, labro continuo, crassiusculo.*

Alt. 1, diam. 2 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Exceedingly small, but well marked, being deeply umbilicate, flattened above, three-whorled, the last whorl large, provided with about twenty-four rounded longitudinal ribs. We know no species exactly comparable, *C. conicum*, Boog Watson, being, perhaps, the nearest, from Pernambuco ('Challenger' Expedition); but this, as its name implies, is conical in form. The interstices between the ribs are, as in *C. conicum*, beautifully spirally striate.

*Cyclostrema prominulum*, sp. n. (Pl. XX. fig. 6.)

*C. testa depresso-discoidali, delicata, alba, minutissima, profunde umbilicata; anfractibus quatuor, quorum duo apicales perlæves, subvitrei, cæteris duobus spiraliter undique multiliratis; liris lævibus, simul ac interstitiis, ultimo permagno, ad peripheriam acuticarinato; carina prominente, deinde ad basim lateribus obliquis, basi tumidula; apertura rotunda, labro tenui.*

Alt. 1, diam. 2 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A very minute species, deeply umbilicate, white, with the surface uniformly multiliriate, the lira at the periphery being metamorphosed into a strong, very prominent, and acute keel.

*Cyclostrema euchilopteron* †, sp. n. (Pl. XX. fig. 7.)

*C. testa parva, profunde umbilicata, albo-lactea, subpellucida, tenui, nitidiusecula, discoidali; anfractibus quatuor, apicali vitreo, lævi,*

\* *Annellus*, a small ring.

† εὐχίλος, πτέρον, from the winged process in connexion with the lip.



omnibus, præter ultimum, depressis, undique concentrice tenuiliris, ultimo recto, tribus carinis acutissimis prædito, prominulis, quorum superiore carina extra labrum projecta porrectionem triangularam præbente; apertura rotunda, labro extus tricarinato, intus simplici.

Alt. 2, diam. 3.50 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

A wonderful little form, which seems from the description to come nearest to *C. Verreauxii*, Fisch., from California. It is a discoidally depressed, deeply umbilicate species, the last whorl furnished with three very prominently ridged keels, acutely projecting, and terminating in a triangularly winged extension of the upper part of the outer lip. Several examples, but by no means so abundant as *C. quadricarinatum*, M. & S., which was in thousands at the above locality.

*Liotia romalea* \*, sp. n. (Pl. XX. fig. 8.)

*L.* testa ovato-rotunda, parva, solida, anguste umbilicata; anfractibus 5, ad suturas excavatis, quorum duo apicales læves, margaritacei, cæteris, antepenultimo uni-, penultimo bi-, ultimo tricarinato, undique longitudinaliter arcte costatis, costis crassis, interstitiis striis longitudinalibus arcte præditis, basim versus, circa umbilicum, costis magnopere tumescentibus, spatio interstitiali spiraliter profunde fenestrato; umbilico profundo, perspectivo; apertura rotunda, intus albescente; peristomate albo, multum incrassato, obscure quinquangulari, continuo.

Alt. 5, diam. 5 mm.

*Hab.* Persian Gulf, Sheikh Shuaib Island, 10 fathoms; Maskat, 10-15 fathoms; also Gulf of Oman, lat.  $23^{\circ} 30' N.$ , long.  $57^{\circ} 10' E.$ , at 10 fathoms.

Several examples of a typical *Liotia*, coarser and smaller than *L. echinacantha*, but beautifully sculptured and with conspicuously thickened peristome, which is seen with the aid of a lens to be very obscurely five-angled.

*Liotia echinacantha*, sp. n. (Pl. XX. fig. 9.)

*L.* testa globosa, anguste sed profunde umbilicata, pallide straminea, robusta; anfractibus quatuor, quorum apicalis depressus, planatus, cæteris pulcherrime et acutissime sculpturatis, antepenultimo duobus, penultimo tribus, ultimo sex squamarum ordinibus prædito, squamis echinatis, spinarum instar, cavis, anfractu ultimo

\* ῥωμάλεος, robust.

(et penultimo) ordine superiore, squamis incurvis, magis conspicuis, arctissime accincto, infra peripheriam, circa umbilicum, tribus ordinibus multe minoribus; apertura rotunda, intus margaritacea; peristomate crassiusculo, umbilico corneo, multispirali. Alt. 6, diam. 7.50 mm.

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 10–15 fathoms.

A very beautiful little shell, not very near any of the genus with which we are acquainted. The scaly spines are characteristic, being fluted, hollow, and profusely covering the surface, thrice-ranked on the penultimate, six-ranked on the last whorl; but three, however, of them are conspicuous, more particularly the one in both whorls just below the sutures. Around the umbilicus the three rows are not so highly developed. The operculum is horny and multispiral.

*Enida persica*, sp. n. (Pl. XX. fig. 10.)

*E. testa parva, depresso-conica, solidula, profunde sed anguste umbilicata, albo-straminea, hic illic, præcipue apud peripheriam, spiraliter pallide rubro vel brunneo maculata; anfractibus 6, apud suturas gradatulis, quorum duo apicales vitrei, canaliculati, læves, cæteris, præcipue ultimo, spiraliter liratis, simul ac infra, juxta suturas, forti carina præditis (ultimo anfractu apud peripheriam bicarinato), longitudinaliter obliquissime sed obscure costulatis, costulis apud ultimum sæpius fere evanidis, ad juncturas lirarum, præcipue supra, gemmulatis, infra peripheriam usque ad umbilicum spiraliter pulcherrime tenuiliratis; lira majore interdum cum minore alternante, undique minute gemmulatis; apertura subquadrata, labro paullum incrassato, regione umbilicari excavata. Alt. 3, diam. 5 mm.*

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Allied to the type of the genus *E. japonica*, Ad., but differing in both size and form. It is not so large or handsome as the recently described *E. Townsendi*, Sowb., from a neighbouring locality. The sculpture is elaborate for so small a shell; the liræ and carinæ on the last whorl number together six above the periphery, while below it there are ten, all being more or less granulate; the base is flattened, umbilical region somewhat excavate, mouth squarrose; the painting is pale red blotching, of a trigonal shape round the last two whorls, and most conspicuous at the periphery. Many examples occurred at the very prolific dredging-station mentioned above.

*Euchelus Townsendianus*, sp. n. (Pl. XX. fig. 11.)

*E.* testa oblongo-conica, straminea, solidula; anfractibus 7, quorum tres pallide straminei, apicales minute crenulati, subhyalini, cæteris spiraliter fortiter costatis; anfractu penultimo, simul ac antepenultimo, costis quatuor, ultimo novem (quorum quinque supra, usque ad peripheriam) undique gemmulatis, interstitiis favulosis, quadratis; apertura ovato-rotunda, labro regulariter brunneo-zonulato, intus multiplicato, margine columellari sinuoso-crenulato.

Alt. 11, diam. 6.50 mm.

*Hab.* Persian Gulf; Gulf of Oman, Maskat, 15 fathoms; also at lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

An *Euchelus* of somewhat familiar aspect, but not precisely comparable with any species either in our National Collection or mentioned in existing monographs.

*Solariella zacalles*\*, sp. n. (Pl. XX. fig. 12.)

*S.* testa depresso-conica, profunde et late umbilicata, pernitida, lævi, solida, læte rufo-brunnea, flammis fulgetrinis maculisque spiralibus hic illie depicta; anfractibus 6, quorum apicales  $1\frac{1}{2}$  crystallini, læves, cæteris ventricosulis, supra, juxta suturas, regulariter spiraliter gemmatis, dein concentrice tenuiliratis, interstitiis perlævibus, ultimo infra peripheriam nitido lævissimo, intus umbilicem pulchre multilirato, liris arcte gemmato-crenulatis, circa umbilicem ipsum radiatim breviter multisulculo; apertura obliqua, subrotunda, intus margaritacea, labro tenui, columella simplici, nequaquam reflexa.

Alt. 4, diam. 9 mm.

*Hab.* Persian Gulf; Gulf of Oman, Maskat, 10–15 fathoms; also in lat.  $24^{\circ} 55' N.$ , long.  $57^{\circ} 59' E.$ , 37 fathoms, sand and mud, and lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

We at first considered this species (and so inserted it in our Catalogue †) as identical with *Minolia gilvospiciens*, Melv., from the Philippines ‡; but, though extremely similar, there exist some very salient points of distinction. The latter is far more conical and the body-whorl obscurely bicarinate at the periphery, the umbilical sculpture in both being identical, this sculpture being, in fact, the chief point of difference between the species under discussion and

\* ζακάλλης, extremely beautiful.

† Proc. Zool. Soc. 1901, vol. ii. p. 349.

‡ Journ. of Conch. vi. p. 407, pl. ii. fig. 8 (1891).

*Solariella radiata*, Phil., from the Agulhas Bank, which is perfectly smooth and simple as regards its umbilical region.

The species of *Solariella* and *Minolia* are in great confusion, and monographs of these two genera are much wanted. The Rev. Dr. Gwatkin is devoting much time to the anatomy of the various forms, and finds many vital differences in the radula of some whose shells are nearly allied. We trust he may be induced some day to publish the results of his researches.

*Calliostoma thrincoma*\*, sp. n. (Pl. XX. fig. 13.)

*C.* testa conico-pyramidali, imperforata, solida, sculpturata, pallide straminea, spiraliter fusco-maculata, vel unicolore; anfractibus octo, apicali vitreo, globulari, cæteris stramineis, ad suturas impressis, tegulatis, spiraliter undique pulcherrime granoso-liratis, supra, juxta suturas, carina prominula decoratis, ultimo anfractu ad peripheriam bicarinato; apertura quadrata, margine columellari triangulatum incrassato.

Alt. 11; diam. 9 mm.

*Hab.* Persian Gulf; Gulf of Oman, near Maskat, lat. 23° 30' N., long. 57° 50' E., 88 fathoms.

Near *C. similare*, Reeve. A highly chased and sculptured species, though of small dimensions, and conspicuously keeled around every whorl just above the suture, the last whorl at the periphery being bicarinate.

*Leptothyra rubens*, sp. n. (Pl. XX. fig. 14.)

*L.* testa globosa, parva, imperforata, solida, nitidula, infra lævissima, pallide straminea, flammis castaneis decorata; anfractibus 4-5, quorum 1½ apicales apice ipso vitreo-albo, mamillato, cæteris gradatulis (ultimo rotundiore), undique infra medium lævibus, nitidis, supra arcu spiraliter sulculosis, ultimo ad peripheriam pallide spiraliter zonato, infra ad basim pulchre rubente; apertura rotunda, labro vix incrassato, nisi marginem apud columellarem albo-callosum, nitidum.

Alt. 4, diam. 4.50 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A highly coloured little shell, which occurred somewhat plentifully at the above locality. The many specimens we have seen agree in sculpture and coloration almost uniformly. Near *L. læta*, Montr.

*Trichotopsis pulcherrima*, sp. n. (Pl. XX. fig. 15.)

*T.* testa tenui, supra pergracili, attenuato-fusiformi, alba vel straminea, ochracea epidermide contexta; anfractibus octo, quorum

\* θρίγκωμα, a battlement.



duo apicales hyalini, læves, cæteris multum apud suturas impressis, spiraliter acute bicarinatis, ultimo quadricarinato, epidermide quasi-costulas longitudinales setulosas arcte præbente; apertura lato ovata, in typico specimine aurantia, in minore alba, labro effuso, tenui, columella fere recta.

Alt. 24, diam. 12 mm. (sp. maj.).

*Hab.* Gulf of Oman, on telegraph-cable, lat. 27° 12' N., long. 51° 50' E., 25 fathoms.

We have already \* described another species of this usually Arctic genus from the Gulf of Oman, viz. *T. Townsendi*—a much smaller form. The present is far handsomer, being conspicuous for its graceful, rapidly attenuate whorls, much impressed suturally, the upper whorls twice, the lowest four times carinate. Two examples so far only obtained, the perfect larger example orange-mouthed, the smaller white. A third species, as yet undescribed, has lately been found to occur in small quantity in the dredging at 156 fathoms in the Gulf of Oman.

*Solarium (Torinia) cerdaleum* †, sp. n.  
(Pl. XX. fig. 16.)

*S.* testa anguste umbilicata, solida, pulchre sculpturata, depresso-conica, fusco-straminea; anfractibus 5, quorum  $1\frac{1}{2}$  apicales pallide rufi, nitidissimi, hyalini, cæteris quatuor ordinibus gemmarum spiraliū, interstitiis minute unistriatis, præditis, quorum inferi regulariter hic illic brunneo-maculati, in penultimo et ultimo anfractu ordine summo, juxta suturas, magno, gemmulato, ultimo ad peripheriam tribus carinis conspicuis brunneo-maculatis, simul ac infra, apud basim, septem ordinibus spiraliū decorato, duo circa umbilicum gemmulas maximas crenelliferas præbentes, interstitiis spiraliū unistriatis; apertura obscure quadrata, intus subochracea, nigro-brunneo zonata, labro angulato, tenui, marginem ad columellarem nitido, albo, incrassato, spiraliū tornato.

Alt. 5, diam. 8.50 mm.

*Hab.* Persian Gulf, Fao, on telegraph-cable, November 1902.

Of the same alliance as *S. dorsuosum*, Hinds, *cylindræum*, Mighels, &c., but differing in the several characters as above given.

*Solarium abyssorum*, sp. n. (Pl. XXI. fig. 1.)

*S.* testa parva, perdepressa, acutissime carinata, profunde umbilicata, tenui, albescente; anfractibus quatuor, quorum apicales  $1\frac{1}{2}$

\* Proc. Zool. Soc. 1901, vol. ii. p. 360.

† κερδάλεος, advantageous.

tumidi, perlæves, hyalini, cæteris apud suturas anguste canaliculatis, supra, juxta suturas simul ac infra, spiraliter liratis, interstitiis utrinque arcte gemmulatis, deinde superficie media nitida, irregulariter longitudinaliter oblique striata, ultimo anfractu circa peripheriam acuticarinato, carina utrinque plano-marginata, infra, basim versus, spiraliter unilirato, dein superficie intermedia longitudinaliter rudicrenata, circa umbilicum ipsum duobus gemmularum ordinibus instructa, umbilico pulchre scalari; apertura trigonali, labro tenui, umbilicum nequaquam obtegente.

Alt. 3, diam. 6 mm. (spec. maj.).

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

A great many examples, but no live specimens occurred, and but few in perfect condition. Allied to *S. oxytropis*, A. Ad., in form, but not in sculpture.

*Fluxina Dalliana*, sp. n. (Pl. XXI. fig. 2.)

*F.* testa perminuta, albo-hyalina, immaculata, depresso-discoidali, umbilicata; anfractibus 4, quorum apicalis globosus, mamillatus, subimmersus, cæteris ad suturas canaliculatis, ventricosulis, lævissimis, ultimo ad peripheriam acuticarinato, carina marginata, sub lente elegantissime et minutissime crenellifera, basi convexiuscula, circa regionem umbilicarem paullum excavata, umbilico angusto, sed profundo, scalari, margine acuto, simplici; apertura subquadrata, columella recta, supra umbilicum triangulatim reflexa.

Alt. .75, diam. 1.50 mm. (sp. min.).

„ 1, „ 2 „ (sp. maj.).

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , at 156 fathoms.

One of the most minute of recent shells; it agrees, however, in many particulars with *Fluxina discula*, Dall\*, dredged in the 'Blake' Expedition off Dominica, W.I., at 982 fathoms. This, however, is nearly five times as large as our species, which was very rare in the above station.

We venture to dedicate this very interesting addition to the Oriental fauna to Dr. W. H. Dall, of Washington, who has done perhaps more than any other author to elucidate the benthal Molluscan fauna, and is the founder of the genus *Fluxina*.

*Homalaxis cornu-Ammonis*, sp. n. (Pl. XXI. fig. 4.)

*H.* testa minuta, alba, omnino evoluta, delicata, depressulo-discoidali; anfractibus quatuor, quorum duo apicales connexi, vitrei,

\* Bull. Mus. Comp. Zool. Harvard College, vol. xviii. p. 273 (1889).

globosi, duobus ultimis hexagonis, utrinque tri-carinatis, squamosis, carinis sex minute et formosissime echinulatis, undique longitudinaliter tenuiliratis, liris arctis, inconspicuis; apertura sex-angulata, intus alba, labro tenui.

Alt. 2, diam. 5 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

A very extraordinary, though minute, species, the chief peculiarities consisting in the completely evolute hexagonal whorls, the keels being most beautifully echinulate, the spaces also between the carinæ are longitudinally lirate. In form it is discoidally depressed, with two glassy globular apical whorls. We cannot exactly follow the reasons which prompt Dr. Fischer (Man. de Conch. p. 714) to propose a subgenus *Pseudomalaxis* for *H. zanclea*, Phil., and consider all the true *Homalaxis*, Desh., tertiary fossils. In our opinion both the species now described belong to the typical genus, and it would be impossible to disassociate *H. pernam-bucensis* (Wats.), described as a *Bifrontia*, from them. In the latter the last whorl is partly evolute.

The Rev. R. Boog Watson (Report 'Challenger' Exped. xv. p. 137) would allow the barbarous term *Omalaxis*, Desh., 1832 \* (afterwards altered to *Homalaxis*), to lapse, it being derived from two languages, and institute *Bifrontia*, also of Deshayes, 1833. But we fear that very many terms used in Zoology, and accepted, are likewise of hybrid origin, and *Homalaxis* must therefore stand, in spite of its disadvantageous origin.

*Homalaxis rotula-catharinaea*, sp. n. (Pl. XXI. fig. 3.)

*H.* testa minuta, depresso-discoidali, alba, delicata, semievoluta; anfractibus quatuor, rectis, utrinque bicarinatis, apicali immerso, simplici, antepenultimo lævi, parum nitente, penultimo, simul ac ultimo, pulcherrime sculpturatis, evolutis, utrinque bicarinatis, carinis—præcipue externis—apud margines minute echinato-crenulatis; apertura quadrata, labro tenui, margine columellari paullulum reflexo.

Alt. 1, diam. 3 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

A most exquisite shell, in many points resembling *H. zanclea*, Phil., but more delicate in every detail. *H. disjuncta*, Lam., a tertiary fossil from Grignon, is very much larger

\* Deshayes, Encyclop. Méthod. vol. iii. p. 659.

indeed, but comes in the same category as our species, which occurred frequently at the above locality. It bears, in miniature, an almost exact resemblance to a catherine-wheel, hence the specific name.

*Cerithium verecundum* \*, sp. n. (Pl. XXI. fig. 5.)

*C. testa parva, solidiuscula, eleganter fusiformi, attenuata, pallide straminea; anfractibus decem, quorum apicales duo fusi, non hyalini, cæteris apud suturas multum impressis, tumidulis, tribus liris spiralibus, ultimo quatuor, omnino accinctis, longitudinaliter costulis obliquis decoratis, ad juncturas costularum lirarumque gemmuliferis, gemmulis lævibus, nitidis, anfractibus hic illic variciferis; apertura oblonga, labro paullum incrassato, apud basim prolongato, columella fere recta.*

Long. 4·20, lat. 1 mm. (sp. maj.).

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A fairly abundant little species, which may be distinguished by its pale straw-colour, irregular varices, channelled sutures, and gemmuled liræ. The most frequent form, however, is smaller than that selected for the type, the apex and general shape being the same, while the whorls are less ventricose, and there is rarely to be seen any trace of varices. This small form may possibly be a separate, very nearly allied species; if so, the line of demarcation is almost too slight to permit of verbal differentiation.

*Scissurella ætheria*, sp. n. (Pl. XXI. fig. 6.)

*S. testa parva, heliciformi, angulatim ovata, obtecte umbilicata, supra depresso-conica, undique alba, delicatissima, eleganter sculpturata; anfractibus 4, quorum apicalis parvus, mamillatus, cæteris infra, juxta suturas, bicarinatis, undique longitudinaliter oblique tenuiliratis, et spiraliter obscure striatis, sub lente ad juncturas pulchre et minutissimo gemmulatis, ultimo ad peripheriam bicarinato, inter carinas ad labrum sinu perlongo, angusto; apertura subrotunda, intus alba, labro ad sinum paululum effuso, margine columellari supra umbilicum angustum extenso.*

Alt. 1·28, diam. 2 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

One of two species of *Scissurella* extracted sparingly from shell-sand gathered at the above rich locality, in company with what we are inclined to consider *S. ædonia*,

\* *Verecundus*, modest.



Watson (cf. 'Challenger' Report, xv. p. 114, pl. viii. fig. 3, a, b).

The species before us is exceedingly beautiful and delicate, the surface finely sculptured, with the anal slit narrow and a millimetre in length. There is some affinity to *S. aëdonia*, Watson, from Pernambuco, but our species is far more depressedly conical and the outer lip more prolonged at the base.

*Fossarus (Couthouya) unicarinalis*, sp. n.  
(Pl. XXI. fig. 7.)

*F. testa minuta, anguste umbilicata, oblonga, nivea, pulcherrime sculpturata; anfractibus quinque, quorum duo læves, vitrei, globosi, apicales, cæteris turritis, undique longitudinaliter tenuiligratis, simul ac spiraliter delicatissime striatis, anfractu penultimo cum ultimo infra, juxta suturas, conspicue unicarinato; carina etiam conspicua circa umbilicum, usque ad basim peristomatis, in quo immergitur, succingenda; apertura ovata, peristomate nitido, candido, incrassato, planato, margine columellari quoque incrassato.*

Long. 3, lat. 2 mm.

*Hab.* Arabian Sea, off Bombay, lat. 18° 48' N., long. 71° 45' E., 40 fathoms.

An excessively small pure white *Couthouya*, but of most distinctive character, the sculpture being remarkably ornate and fine. The last two whorls are sharply keeled, and on the body-whorl another keeled projection surrounding the narrow umbilicus merges at the base with the white, thickened, and flattened peristome. Aperture ovate, columellar margin thickened.

*Adeorbis axiotimus*\*, sp. n. (Pl. XXI. fig. 8.)

*A. testa paullum depressa, profunde umbilicata, alba, delicata, subpellucida; anfractibus 4, quorum apicalis fere immersus, minutus, huic proximus anfractus magnopere inflatus, nitidulus, ultimo cæteros multum exsuperante, undique, cum penultimo, tenuissime longitudinaliter striato; apertura magna, ovato-rotunda, labro tenui, simplici, continuo.*

Alt. 75, diam. 2 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Very delicate and subtransparent; the apical whorl is almost immersed and depressed owing to the tumidity of the next, which is shining and almost smooth, the last whorls being beautifully and finely striate.

\* ἀξιώτιμος; worthy of honour.

*Erato recondita* \*, sp. n. (Pl. XXI. fig. 9.)

*E.* testa parva, nitida, alba, lævissima, tenui; anfractibus  $5\frac{1}{2}$ , apicali obtuso, mamillato, cæteris lævibus, immaculatis, ultimo magnopere exsuperante; apertura angusta, labro supra paullum effuso, nitido, albo, incrassato, intus minute denticulato. Long. 5, lat. 3 mm. (sp. maj.).

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

Var. (vel sp.?) *haplochila*, nov. (Pl. XXI. fig. 10.)

*E.* testa ut supra, sed labro intus simplici, plano, nequaquam denticulato.

*Hab.* Gulf of Oman, cum præcedente.

Although this var. is not denticulate in the inner side of the lip, we cannot disassociate the two forms of this interesting *Erato*. It is evidently benthal in its habit, and the discovery of more specimens may furnish links to bind these two forms yet closer together.

*Eulima decagyra*, sp. n. (Pl. XXI. fig. 11.)

*E.* testa minutissima, candida, polita, fusiformi, superne multum attenuata; anfractibus 10, apicali obtuso, diaphano, pernitido, cæteris applanatis, politis, ultimo basim versus ovato, solidiusculo; apertura parva, ovata, labro paullum incrassato; columella declivi, apud basim angulatim incrassata, nitida. Long. 2.75, lat. 1 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

A shining, white, polished species, noteworthy for its gradually attenuate spire, ovate thickened base, and aperture proportionately small. We do not know any *Eulima* exactly comparable nor, we may add, so minute. We are indebted to Mr. Sykes for having extricated two examples from a mass of shell-sand.

*Rissoïna isosceles* †, sp. n. (Pl. XXI. fig. 12.)

*R.* testa eleganter attenuato-fusiformi, cinereo-alba, solidula; anfractibus 9, quorum 3 apicales hyalini, bulboso-globulares, cæteris longitudinaliter arcte costulatis, apud supernos magis fortibus, paucioribus, undique sub lente spiraliter tenuissime striatis, infra peripheriam ultimi anfractus angulatam evanidis;

\* *Reconditus*, hidden.

† *ισοσκελής*, from the basal shouldered angles.

apertura ovata, labro effuso, basim versus paullum producto, incrassato; columella obliqua.

Long. 5·25, lat. 2 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

An attenuate graceful species of the typical section of the genus, angled below the periphery, nine-whorled, the three globularly bulbous apical whorls being distinctive, the longitudinal ribs on the fourth and fifth whorls being fewer and more pronounced than on the lower—indeed they become obsolete below the periphery of the body-whorl. With a lens the delicate spiral striation is discernible. Mouth triangularly ovate, outer lip produced at the base.

*Rissoina (Zebina) registomoides*, sp. n. (Pl. XXI. fig. 13.)

*R.* testa perminima, globulari, solidula, lævissima, nitida; anfractibus 5, quorum apicalis obtusus, vitreus, cæteris apud suturas subimpressis, ventricosulis, ultimo paullum effuso, obliquo; apertura ovato-rotunda, labro incrassato, albo, nitente.

Long. 2·25, lat. 1·50 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Very minute, but extremely interesting. We are indebted to Mr. E. R. Sykes for its discovery, while sorting shell-sand received from the above most rich dredging. It is much smaller and more globose than any *Zebina* yet described; the peristome is wonderfully incrassate for so small a shell and quite simple, never dentate, thus being unlike any of the numerous varieties of *R. tridentata*, Mich., = *Eulima curta*, Sowb. The facies is eulimoid, but it possesses the apex of a *Rissoina*, and we are satisfied as to its location here. The trivial name is suggested by its form, when magnified, though more globular, somewhat resembling the terrestrial *Registoma fuscum*, Gray.

*Eulimella carmanica*, sp. n. (Pl. XXI. fig. 14.)

*E.* testa minuta, fusiformi, albo-lactea, lævissima, polita, tenui; anfractibus 8–10, quorum apicales heterostrophii, hyalini, lactei, cæteris fere rectis, apud suturas leniter canaliculatis, supernis paullum gradatis, ultimo recto, prolongato; apertura quadrato-rotunda, labro recto; columella obliqua, simplici.

Long. 4, lat. 1·20 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A pure white, polished, fusiform species, very slightly attenuate; upper whorls gradate, all slightly channelled suturally, more or less straight. Mouth somewhat square, outer lip porrect, squarely produced at the base. Columella oblique, simple. Several specimens occurred. Not so elegant as *E. kaisensis*, Melv., the only other of the genus yet recorded from this region. "Carmania," from whence the specific name is taken, is the ancient name of that portion of Persia impinging on the northern shores of the Gulf of Oman.

*Syrnola mussandamica*, sp. n. (Pl. XXII. fig. 1.)

*S.* testa parva, candida, nitida, polita, semipellucida; anfractibus duodecim, quorum duo apicales heterostrophii, bulbosi, cæteris apud suturas haud profunde canaliculatis, nitidis, politis, ultimo longitudine penultimum et antepenultimum anfractum exæquante; apertura ovata, labro haud effuso, tenui; columella obscure uniplicata.

Long. 5·50, lat. 1·50 mm. (sp. min.); long. 7, lat. 2 mm. (sp. maj.).

*Hab.* Gulf of Oman, Mussandam, 47 fathoms.

A shining, white, polished shell, somewhat excavate at the sutures, twelve-whorled, of which the five lowest are much the same girth. The apical whorls are heterostrophie, in common with all of the Pyramidellidæ. There is no *Syrnola* very near this in the North-Indian fauna; indeed, it seems to impinge closely on *Eulimella*.

*Mormula persarum*, sp. n. (Pl. XXII. fig. 2.)

*M.* testa pergracili, attenuato-fusiformi, ochraceo-brunnea, tenui; anfractibus 12, quorum apicalis heterostrophus, lævis, albo-vitreus, cæteris ventricosulis, apud suturas impressis, arcte longitudinaliter costatis; costis obtusis, crassis, interstitiis spiraliter liratis, liris supra sæpe evanidis, obscure undique infra suturas ad medium uni- vel bi-albizonatis, ultimo anfractu infra peripheriam ad basim planato, simpliciter spiralilirato, anfractibus interdum varicosis; apertura rotundo-ovata, labro tenui, dorsalter varicoso, albo-stramineo vel brunneo; columella alba, recta.

Long. 12·50, lat. (ad aperturam) 3·50 mm.

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

Allied to *M. Macandrea*, A. Ad., but with more regular whorls and ribs, the varices being fewer and less pronounced. The colour also is more uniform, being of a warm fuscous chestnut, and the outer lip not denticled within. A remarkably elegant shell.



*Actæopyramis lætitia* \*, sp. n. (Pl. XXII. fig. 3.)

*A.* testa parva, oblongo-fusiformi, alba, nitidiuscula, solida; anfractibus 5-6, quorum apicalis heterostrophus, lævis, vitreus, cæteris apud suturas gradatulis, pulcherrime cancellatis et decussatis, costis ad juncturas sulcorum spiralia nitidis, gemmulatis; apertura ovata, labro paullulum incrassato; columella fortiter uniplicata.

Long. 3, lat. 1 mm.

*Hab.* Persian Gulf, Mussandam, 47 fathoms.

Of the same character as *A. granulata*, A. Ad., from the Philippines, but only half the size (3 as against 6 mm.).

There appears to be a close connexion between certain of this genus and some included at present in *Miralda*, A. Ad. It is often hard to draw any precise lines of demarcation between these genera.

*Actæopyramis brevicula*, sp. n. (Pl. XXII. fig. 4.)

*A.* testa minutissima, abbreviata, alba, compressiuscula, solida; anfractibus quatuor, quorum apicalis heterostrophus, vitreus, lævis, cæteris suturis gradatulis, longitudinaliter crassicostulatis, spirali-ter undique rudiliratis; apertura ovata, apud basim paullum incrassata; columella uniplicata.

Long. 1.75, lat. 1 mm.

*Hab.* Persian Gulf, Sheikh Shuaib I., 15 fathoms.

Very minute, but characterized by its compressed abbreviate form and rude sculpture, the whorls all gradately angled at the upper part. The figure hardly shows the ribs sufficiently prominently, and there is no decussation or granulation to speak of.

*Pyrgulina manoræ* (Melv.). (Pl. XXII. fig. 5.)

*Turbonilla* (*Pyrgostelis*) *manoræ*, Melv. Mem. Manch. Soc. vol. xliii. (1898), no. 4, p. 23, pl. i. fig. 22.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

We have caused this species to be again figured on a highly magnified scale, the result being to decide us that it should be considered a *Pyrgulina*, allied to *Edgarii*, Melv., and *interstriata*, Souv., in spite of the apparent absence of the columellar plait. The original specimens came from off Manora Point, Karachi, where they were plentifully dredged at a slight depth by Mr. Townsend.

*Scala* (*Constantia*) *intertexta*, sp. n. (Pl. XXII. fig. 6.)

*M.* testa gracili, fusiformi, albida, delicata; anfractibus 10, quorum apicales tres parvi, vitrei, læves, cylindrici, cæteris ad suturas

\* *Lætitia*, delight, gladness.

multum impressis, pulcherrime regulariter decussatis, ad juncturas lirarum spiralium cum costulis fimbriolatis, ultimo anfractu paullum prolongato; apertura obliquiovata, labro effuso; columella paullum incrassata, simplici.

Long. 7, lat. 1.75 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Rarely has a small mollusk caused such perplexity as in the present instance. Two examples alone have occurred, but both have the apex perfect, this being non-heterostrophe, though in most other particulars the form and texture recall such pyramidelloid genera as *Mormula*, *Pyrgulina*, or *Mumiola*, especially one species of the latter genus—*M. spirata*, A. Ad.—which also occurs in the same seas.

Mr. Edgar Smith considers *Onoba egregia*, A. Ad. (which should be removed from that genus), the nearest approach to our shell, and suggests that it might, at all events provisionally, be located in *Aclis*. In lip-characters it assimilates this genus, while resembling in the decussating sculpture a *Cirsotrema*, e. g. *dentiscalpium*, Wats. But perhaps the subgenus *Constantia* of *Scala* is best fitted for its reception, for it seems comparable with *C. Standeni*, Melv.\*, also from the Gulf of Oman, in more than one point.

*Nassa (Alectryon) himeroessa* †, sp. n. (Pl. XXII. fig. 7.)

*N.* testa minuta, ovata, albo-vitrea, delicata, apud basim et sæpe ad suturas pallide stramineo-suffusa, vel zonata; anfractibus 6-7, quorum 3½ apicales læves, vitrei, spiraliter unicarinati, cæteris apud suturas gradatulis, longitudinaliter arcute lævicostatis, interstitiis undique tenuiliratis; apertura fere rotunda, intus alba, labro incrassato, intus spiraliter striato; columella paullum excavata, canali brevissimo.

Long. 5, lat. 2 mm.

*Hab.* Gulf of Oman, at several dredging-stations in lat. 23° to 25° N., long. 57° to 59° E.

Depth ranging from 7-156 fathoms.

We at first confounded this species with *N. babylonica*, Watson, and most probably the latter does not occur in the Persian Gulf region. The present species is locally very abundant, and the fine smooth ribs, small size, subpellucid substance, and less graduate whorls will serve to distinguish it.

*Tritonidea Sowerbyana*, sp. n. (Pl. XXII. fig. 8.)

*T.* testa ovato-fusiformi, solidula, epidermide setulosa tenuiter con-

\* Ann. & Mag. Nat. Hist. ser. 7, vol. iv. pp. 92, 93, pl. i. fig. 11.

† *ἡμερόεις*, pleasing.

testa, albida, infra, juxta suturas et infra medium anfractus ultimi castaneo-zonata; anfractibus 8-9, quorum apicales  $3\frac{1}{2}$  pellucidi, lævissimi, cæteris ventricosi, multum apud suturas impressis, longitudinaliter costatis, costis crassis, numerosis (ultimo anfractu apud 10), omnino spiraliter arctissime liris; apertura rotundo-ovata, alba, labro arcuato, crassiusculo, intus albo, multierenulato; columella recta, operculo corneo, tenui, nucleo apicali, canali brevi, paullum recurvo.

Long. 31, lat. 18 mm.

*Hab.* Gulf of Oman and Mekran Coast, especially between Gwadûr and Jask, from 25-30 fathoms, "usually occurring with *Murex malabaricus*" (F. W. T.).

Also lat.  $25^{\circ} 20'$  N., long.  $58^{\circ} 50'$  E., at 90 fathoms, in company with *Latirus pagodaiformis*, Melv., June 1903.

This beautiful species was first pointed out to us as distinct by Mr. G. B. Sowerby. It is near the old *Buccinum ligneum*, Reeve, = *Tritonidea Cecillei*, Phil. It differs in being of stouter build, with the whorls not so scalate. There is likewise an affinity with *T. erythrostoma*, Reeve, but the lip is never coloured in the slightest degree.

*Metula daphnelloides*, sp. n. (Pl. XXII. fig. 9.)

*M.* testa eleganter fusiformi, albida, delicata, mitrali; anfractibus 9, quorum  $4\frac{1}{2}$  apicales albo-vitrei, læves, spiraliter circumcarinati, supernis una, inferis duabus carinis præditis, cæteris apud suturas gradatulis, undique longitudinaliter pulcherrime et arcu costatis (ultimi anfractus ad 46), costis rectis, lævissimis, nitentibus, interstitiis spiraliter liris, infra, juxta suturas, plica spirali conspicua sæpe prædita, superficie hic illic obscure stramineo maculata et depicta, ultimo anfractu (11 mm. in longitudine) gracili, paullum producto; apertura anguste oblonga, intus alba, nitida, labro paullulum effuso, crassiusculo, intus multidenticulato; columella incrassata, pernitida, simplici, basi lata.

Long. 17, lat. 5.50 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

Two species of the genus occurred together, the above being mitriform, elegantly spindle-shaped, and white; the other is the *Buccinum metula*, Hinds, = *Metula Hindsii*, Adams and Reeve, which should properly, we consider, be known by the duplicated name of *Metula metula* (Hinds). This last is larger, with coarser ribs and spiral liration, and does not possess the obscure straw maculations of the *M. daphnelloides*.

The apical whorls are well worth examination. Four or five in number, out of a total of nine in all, they are glassy vitreous white, the extreme apex mamillate, small, the next

whorl with one keel, the others twice spirally carinate, the remainder of the whorls being closely longitudinally ribbed; ribs smooth and shining, white, the interstices closely spirally lirate. The mouth and lip of the new form resemble those of *Metula Hindsii*, but are finer, and the inner labral denticulations more numerous.

*Murex (Ocinebra) Marjoria*, sp. n. (Pl. XXII. fig. 10.)

*M.* testa solida, ovato-oblonga, albo-cinerea; anfractibus sex, undique costatis, costis percrassis, varicosis, sex-fimbriato-squamatis, numero anfractum apud ultimum quinque, ad medium anguliferis, spiraliter squamato-liratis, liris rudibus, crassis; apertura rotundo-ovata, labro extus pulcherrime multifimbriato, albo vel stramineo, crasso, intus nitido, 9-10-crenulado, canali brevirostrato, fere clauso.

Long. 25, lat. 13.50 mm.

*Hab.* Persian Gulf, Sheikh Shuaib Island, 15 fathoms.

An exceedingly elaborately frilled species, the fimbriae being thick and squamate, with fluted processes. In form this shell recalls *M. coccineus*, A. Ad.; the outer lip is either white or straw-coloured, the canal is shortly rostrate, almost closed. *M. cyclostoma*, Sowb., is a near ally; we have Erythræan specimens of this, but the form is much more rotund and the fimbriations in no way so elaborate.

*Peristernia corallina*, sp. n. (Pl. XXII. fig. 11.)

*P.* testa solida, parva, ovato-fusiformi, cinereo-albescente; anfractibus 6, apicali lævi, simplici, cæteris longitudinaliter crassicostatis, costis paucis, in ultimo apud 7, undique spiraliter rudiliratis; apertura anguste ovata, pallide punicea vel carnea, labro intus denticulato, margine columellari paulum reflexo; columella quadriplicata, canali brevi, recurvo.

Alt. 13, lat. 9 mm.

*Hab.* Persian Gulf, Gulf of Oman, near Maskat, 10 fathoms.

A somewhat solid, small, but well-grown *Peristernia*, unlike any species known to us, being superficially similar to a *Coralliophila*; indeed, as suggested by the specific name, we should imagine it would be found ultimately inhabiting corals. The surface is chalky-ash, longitudinally rudely ribbed, crossed by equally coarse spirals; mouth pale pink, ovate, outer lip thickened, seven-denticled within, columella four-plaited.

*Mitra (Costellaria) diaconalis* \*, sp. n. (Pl. XXII. fig. 12.)

*M.* testa fusiformi, solidula, albo-straminea, apicem versus attenuata; anfractibus 12, quorum apicales tres fusco-hyalini,

\* *Diaconus*, a deacon.



perlæves, cæteris apud suturas paullum gradatis, arcte longitudinaliter costatis, costis lævissimis, albis, nitidis, interstitiis spiraliter sulculosis, nitentibus, undique hic illic stramineo vel ochraceo, præcipue juxta suturas et apud peripheriam maculatis et infra, depictis; apertura anguste oblonga, intus striata, ochracea, labro tenui, paullum effuso; columella quadriplicata.

Long. 13, lat. 4.25 mm.

*Hab.* Persian Gulf, Sheikh Shuaib Island, at 15 fathoms, among coral-sand.

A *Costellaria* allied to *M. scitula*, Ad., which, however, possesses the whorls more scalate and with darker maculations and shading; it is, moreover, a smaller species. To *M. impressa*, Reeve, known to us only by a figure, there is a resemblance: this shell, however, is of a uniform dark hue, and the ribs seem more incrassate. The number of longitudinal costæ in our species on the body-whorl is from 26 to 28.

*Marginella (Glabella) alchymista* \*, sp. n.  
(Pl. XXII. fig. 13.)

*M. testa parva, fusiformi, nitidissima, subdiaphana, delicata; anfractibus quinque, lævissimis, apud suturas paullum impressis; apertura oblonga, labro nitido, incrassato, intus supra conspicue unidentato, superficie omni dorsaliter lævi; columella quadriplicata.*

Var. *a. chrysalchyma*, nov.

Testa aureo-straminea, dorsaliter, cum labro, omnino rufo-suffusa, vel spiraliter bizonata.

Long. 5, lat. 2.50 mm.

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 10–15 fathoms.

Var. *b. leucalchyma*, nov.

Testa major, omnino candida, immaculata; labrum candidum, nitens.

Long. 6, lat. 3 (sp. maj.).

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 10–15 fathoms; also at 156 fathoms, lat. 24° 58' N., long. 56° 54' E., and at 205 fathoms, lat. 24° 5' N., long. 57° 55' E.

A very pretty, shining *Glabella*, its spire more elongate than *fusiformis*, Hinds, with which it has been hitherto confounded, and as which it is inserted in our Catalogue †. It is comparable with *M. alta*, Wats. ('Challenger' Expedition), from Cape York, N.E. Australia.

\* *Alchymista*, an alchemist.

† Proc. Zool. Soc. 1901, vol. ii. p. 425.

If slightly local, it is very abundant where it occurs. The colour in the var. *a* is a subdiaphanous golden brown or straw, and there is a very conspicuous suffusion just behind the outer lip of deep rufous brown, bifurcating over the labrum itself. The commoner form is var. *b*, larger as a rule, and pure milky-white throughout, very smooth and somewhat shining. In one or two examples an intermediate form seems to occur, the last whorl being here white, obscurely bizoned with two clear chestnut lines, or, indeed, occasionally trizoned. In fact it is a variable species.

*Terebra helichrysum* \*, sp. n. (Pl. XXII. fig. 14.)

*T.* testa gracillima, multum attenuata, aciculata, nitente; anfractibus 22, quorum  $3\frac{1}{2}$  apicales læves, vitrei, cæteris paullum apud suturas gradatis, læte stramineis, supra, juxta suturas, zona callosa spiraliter præditis, hic illic regulariter albo et rufo maculatis, deinde, inter costas breves, longitudinales, obtusas, nitidas, profunde interstitialiter foraminatis et sulcatis, costis anfractus ultimi ad basim evanidis; apertura ovata, parva, labro tenui, canali brevi.

Long. 24, lat. 5 mm.

*Hab.* Persian Gulf, Mussandam, 47 fathoms.

A most elegant species, the tumid callous zone just below the sutures delicately variegated spirally with white and pale rufous, then obtusely ribbed, the interstices, especially the upper row, being deeply pitted.

*Pleurotoma (Gemmula) navarchus* †, sp. n.  
(Pl. XXI. fig. 15.)

*P.* testa eleganter fusiformi, solida, paullum nitente, pallide cinereo-brunnea; anfractibus tredecim, quorum duo apicales nitidi, hyalini, perlæves, cæteris apud suturas impressis, ventricosulis, infra suturas spiraliter pulcherrime et arcte nodoso-cingulatis, nodulis hic illic rufo-maculatis, deinde fortiter uniliratis, simul ac infra, juxta suturas, bisulcatis, superficie intermedia lata, nitida, longitudinaliter obliquissime costulata, ultimo anfractu cæteros exæquante, infra cingulum liramque spiralem usque ad peripheriam lævi, deinde anguste sulculoso, infra usque ad basim sulculis tornatis, latioribus, liris intermediis regulariter rufo maculatis; apertura oblonga, intus planata, labro tenui, sinu lato, haud profundo; columella fere recta, canali subprolongato.

Long. 64, lat. 18, apertura cum canali 28 mm. longa.

*Hab.* Persian Gulf, Gulf of Oman, lat.  $25^{\circ} 19' N.$ , long.  $58^{\circ} 10' E.$ , 140 fathoms.

\* *ἐλίχρυσον*, an everlasting, from the bright rufous spotting.

† *ναύαρχος*, an admiral.

One specimen only dredged, at the locality just given, of a superbly tornate and sculptured *Pleurotoma*, near *P. carinata*, Gray, *Kieneri*, Doumet, or *congener*, Smith, being remarkable for its regular beaded spiral zone just below the sutures of each whorl, above which are two spiral clearly-cut grooves, the middle of the upper whorls being most beautifully obliquely costulate, the costæ terminated above by a double sulcus surrounding a narrow spiral lira. The last whorl, equalling the others in size, is almost entirely grooved and spirally lirate, the liræ below being rufous-spotted. Outer lip thin, perhaps not quite fully developed, sinus well marked but not deep; columella somewhat straight; canal broad and rather prolonged.

The discovery of this mollusk, the finest Gastropod yet discovered by Mr. Townsend, if we except *Conus clyptospira*, M. & S., adds another magnificent Pleurotomid to the many fine species of this family obtained in contiguous waters, during the 'Investigator' Expedition chiefly (such forms as *P. symbiotes*, Wood-Mason & Alcock, *P. congener*, Smith, and *P. subcorpulenta*, Smith \*, occurring to one's recollection at once), and gives another proof of its wonderful development in Indian seas.

*Drillia dives*, sp. n. (Pl. XXII. fig. 15.)

*D. testa gracili, fusiformi, delicata, albo-cinerea; anfractibus decem, quorum tres apicales brunnei, omnino hyalini, lævissimi, cæteris apud suturas impressis, ventricosulis, longitudinaliter obliquicostatis, costis anfractum apud ultimum circa undecim, undique spiraliter striatis, supra, juxta suturas, zona spirali rufa decorata, ultimo anfractu simili modo bizonato, ad basim producto albo, nitido; apertura oblonga, labro paullum incrassato, sinu lato, haud profundo, canali brevi.*

Long. 17, lat. 5 mm.

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

Allied to *D. clydonia*, M. & S. (Proc. Zool. Soc. 1901, vol. ii. p. 437, pl. xxiii. fig. 24), but the whorls are not angled, the coloration is quite different, and the spiral ribbing is coarser in *D. dives*.

*Drillia philotima* †, sp. n. (Pl. XXII. fig. 16.)

*D. testa attenuata, fusiformi, solidula, albo-cinerea, aspera; anfractibus 11, quorum duo apicales vitrei, fusci, cæteris ventricosulis, regulariter obliquicostatis, costis anfractus ad superos paucis,*

\* Ann. & Mag. Nat. Hist. ser. 6, vol. xiv. pp. 160, 161, pl. iii. figs. 4-8.

† φιλότιμος, honoured.

crassioribus, in ultimo et penultimo numerosis, ad quindecim, et angustioribus, brunneo tinctis, suffusis, et maculatis, transversim nodiliratis, ultimo anfractu dorsaliter juxta labrum varicoso, brunneo suffuso et zonato; apertura oblonga, angusta, intus alba, labro paullum effuso, sinu distincto, profundo, canali lato, brevi; columella recta.

Long. 30, lat. 8 mm.

*Hab.* Persian Gulf, off Bahrein Islands, 30–50 fathoms.

Only one example secured of a distinct and handsome *Drillia*, the nearest approximation to which is to be found in *D. latifasciata*, Sowb., from Japan, considered by some authors as synonymous with *D. japonica*, Lischke. There is no beading at the sutures, however, and the form is more graceful.

*Drillia continua*, sp. n. (Pl. XXII. fig. 17.)

*D.* testa attenuata, fusiformi, lævissima, alba, nitida; anfractibus  $10\frac{1}{2}$ , quorum  $1\frac{1}{2}$  apicales subvitrei, nitidi, complanati, cæteris longitudinaliter paucicostatis, costis exacte inter se continuis, lævibus, albis, infra medium delicate uniangulatis, anfractu ultimo apud basim paullum pyriformi, numero costarum ad octo; apertura subobliqua, oblonga, intus alba, labro haud multum incrassato, sinu lato, sed non profundo.

Long. 10, lat. 3·75 mm.

*Hab.* Persian Gulf, Mussandam, 47 fathoms.

Akin to *D. opalus*, Reeve, and conspicuous for its exactly continuous longitudinal ribs, those of whorl succeeding whorl descending in a perfectly straight line to the base. These whorls are slightly once-angled beyond the centre. The whole surface is white, with a slight ochreous tinge, and smooth.

*Drillia granatella*, sp. n. (Pl. XXII. fig. 18.)

*D.* testa parva, læte punicea, solida, nitida, fusiformi; anfractibus 6, duobus apicalibus perlævibus, puniceis, hic illic albo suffusis, cæteris crassicostatis, costis paucis, lævibus, nitidis, numero ultimum apud anfractum circa 7, superficie omnino lævissima, dorsaliter juxta labrum gibberula; apertura breviter ovata, labro tenui, albo-suffuso, sinu lato, canali brevissimo.

Long. 5, lat. 1·50 mm.

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

This little species, though so small, is in our opinion a *Drillia* rather than *Mangilia*, being nearly allied to the beautiful series of *Drillie*—viz.: *disjecta*, Smith, *persica*, Smith, and *resplendens*, Melv.—peculiar to the same region.



It is a remarkably smooth and shining shell, and the pomegranate-pink colour (like the fruit of *Punica granatum*, L.) seems characteristic and quite peculiar.

*Drillia lithoria* \*, sp. n. (Pl. XXII. fig. 20.)

*D. testa* parva, fusiformi, pallide rufa, solidula; anfractibus 8, quorum 2 apicales læves, vitrei, cæteris magnopere supra medium anfractum tumescentibus et spiraliter noduliferis, nodulis paucis, gemmatis, dein, anfractus apud supernos, tornatis, ultimo anfractu basim versus spiraliter pauciltrato, liris pulchre et minute gemmatis; apertura quadrato-ovata, labro tenui, sinu lato, haud profundo, canali brevi.

Long. 8, lat. 2.50 mm.

*Hab.* Persian Gulf, Bahrein Islands, 6 fathoms, coral-sand.

A small highly-coloured species, with conspicuous, spiral, swollen, nodulous angle just above the centre of the whorls. We cannot connect it nearly with any other species.

*Drillia audax*, sp. n. (Pl. XXIII. fig. 1.)

*D. testa* oblongo-fusiformi, solida, parva, albo-straminea; anfractibus septem, quorum tribus nitidissimis, hyalinis, lævibus, apicalibus, cæteris triuis, antepenultimo quaternis, ultimo circa viginti spiralia lilarum ordinibus accinctis, ad anfractus supernos gemmulatis, supra suturas, etiam, lira spirali fortiori decorato, omnibus his liris stramineo-ochraceis; apertura ovato-oblonga, sinu distincto, lato, canali brevissimo, lato, margine columellari excavato.

Long. 9.25, lat. 2.50 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A little species of bold contour, and very distinct in both sculpture and painting of the spiral straw-coloured liræ surrounding the whorls, which are not costulate. One spiral lira, acute and prominent, is especially noticeable at the base of each whorl, just above the sutures.

A good many examples occurred in the dredging, as above, in shell-sand.

*Mangilia comideleuca* †, sp. n. (Pl. XXIII. fig. 5.)

*M. testa* parva, angulari, fusiformi, omnino albida, solida; anfractibus 9, quorum duo apicales læves, globulares, vitrei, cæteris ad

\* λίθος, in sense of a precious stone.

† κομιδῇ, altogether; λευκός, white.

medium angulatis, longitudinaliter paucicostatis, spiraliter undique rudiliratis, interstitiis albis, labro dorsaliter multum incrassato, angulari; apertura sinuoso-oblonga, sinu perlato, margine columellari tristriato, canali lato, brevi.

Long. 8, lat. 3 mm.

*Hab.* Persian Gulf, Mussandam, 47 fathoms.

Most resembling *M. spurca*, Hinds, found abundantly in the same region, but differing in colour (the new form being entirely white), in size (8 as against 14 or 15 mm.), and in greater angularity of whorl. The somewhat sinuous or trigonous aperture and very thickened peristome are the same in both species. Only one or two examples have yet occurred.

*Clathurella opsimathes* \*, sp. n. (Pl. XXII. fig. 19.)

*C. testa* oblongo-fusiformi, solidula, nitida, cinerea, albo et fusco zonata; anfractibus 10, quorum 3 apicales, cæteris circa suturas lævibus, planatis, aliter undique longitudinaliter crassicostatis, costis paucis (numero ultimum apud anfractum 10), spiraliter pulchre superne 3-, ultimo 10-liratis (ad peripheriam albizonato), liris albo-cinereis, conspicuis, supra costas angulosis; apertura oblonga, labro incrassato, echinulato, fusco et albo depicto, sinu lato, haud profundo; columella recta, canali lato, brevi.

Long. 16.50, lat. 6 mm.

*Hab.* Persian Gulf, Sheikh Shuaib Island, 15 fathoms.

Hitherto confounded with *C. (Glyphostoma) rugosa*, Migh., a quite different species. It is a prettily sculptured and painted shell, with conspicuous beading and spiral well-cut liræ.

*Clathurella Sykesii*, sp. n. (Pl. XXIII. fig. 4.)

*C. testa* parva, perangusta, attenuato-fusiformi, albo-cinerea; anfractibus 8-9, quorum apicales duo læves, cæteris ad suturas permultum impressis, angulosis, ventricosis, longitudinaliter acuticostulatis, costis paucis, numero ultimum apud anfractum circa 9, undique spiraliter liratis, liris rudibus (in penultimo et ultimo circa 6), prominulis; apertura ovata, labro tenui, sinu conspicuo, profundo, canali longo.

Long. 7, lat. 2 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

We are indebted to Mr. Ernest R. Sykes for calling our attention to this curious little species, so like a *Fusus* in

\* *ὀψιμάθης*, late in being discerned.

miniature. It is one of the narrowest *Clathurellæ* in proportion to its length yet discovered, and is wonderfully symmetrical throughout. All the examples, of which there are several, are dead, and perhaps in life there may be coloration of some kind. It is common at the above station, in company with another nearly allied *Clathurella* that we hope to describe shortly.

*Clathurella quisquilia* \*, sp. n. (Pl. XXIII. fig. 7.)

*C.* testa attenuata, fusiformi, angusta, solidula, omnino albida; anfractibus 9–10, quorum duo apicales bulbosi, læves, vitrei, cæteris paucicostatis, costis crassis, numero ultimum apud anfractum 5, spiraliter undique liris rudibus succinctis; apertura ovato-trigona, labro incrassato, sinu lato sed non profundo; columella fere recta, canali brevi.

Long. 7, lat. 2 mm.

*Hab.* Persian Gulf, Mussandam, 47 fathoms; also Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

Attenuate and narrow, thickly longitudinally ribbed, and encircled throughout with markedly coarse lirations. It did not occur at all plentifully at the above station, only three or four examples having as yet been seen.

*Daphnella* (*Pleurotomella*) *nereïdum* †, sp. n.  
(Pl. XXIII. fig. 2.)

*D.* testa ovato-oblonga, subpellucida, delicata, albo-lactea; anfractibus 8–9, quorum  $2\frac{1}{2}$  vel 3 apicales pallide rufi, tenuissime decussati, cæteris ad medium angulatis, ad suturas paullum impressis, arete cancellatis, interstitiis quadratulis, costis lirisque transversis crystallinis, ultimo anfractu supra medium angulari, costis dorsaliter juxta labrum sæpe evanidis; apertura anguste ovata, intus alba, labro tenui.

Long. 7, lat. 3 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

A crystalline form of unusual beauty. In form this assimilates *P. filifera*, Dall, but the apical whorls are not smooth, but decussate.

\* *Quisquiliæ*, trifles.

† *Nereïdum*, of the sea-nymphs.

*Daphnella (Pleurotomella) Amphitrites* \*, sp. n.  
(Pl. XXIII. fig. 3.)

*D.* testa ovato-cylindrica, delicata, subhyalina, albo-lactea; anfractibus 7-8, quorum  $2\frac{1}{2}$  apicales albi, sub lente pulchre decussati, cæteris longitudinaliter lirato-costulatis, spiraliter liris crassioribus succinctis, ad juncturas costularum cum liris gemmulatis, nitidis, infra medium anfractus antepenultimi et penultimi duabus spiralibus liris magis conspicuis, cariniferis, simul ac in ultimo, ad peripheriam; apertura ovato-oblonga, intus hyalina, alba, labro tenui, canali brevi, paullum recurvo.

Long. 8, lat. 3 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

The two species *D. Amphitrites* and *D. nereïdum* occur together, but we think it correct to separate them, though undoubtedly they are nearly allied. The present species is the less angular, rather larger, and of a more roundly cylindrical form.

*Daphnella thygattrica* †, sp. n. (Pl. XXIII. fig. 6.)

*D.* testa parva, fusiformi, tornata, albo-straminea, longitudinaliter pallide rufo-tincta; anfractibus 7, quorum tres apicales apice ipso lævi mamillato, duobus pulchre sub lente decussatis, cæteris spiraliter ad medium, ultimo ad peripheriam duplo-carinatis, lirisque lævibus, fortiter succinctis, ultimo anfractu ad medium, inter carinas, recto; apertura oblonga, labro tenui, sinu obscuro, margine columellari incrassato, albo, nitido, canali lato, paullum producto.

Long. 7, lat. 2.50 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

A small *Drillia* in miniature, looked at superficially, but the decussate apical whorls are Daphnelloid. It occurred somewhat commonly at the above station.

*Daphnella thia* ‡, sp. n. (Pl. XXIII. fig. 8.)

*D.* testa delicatissima, subpellucida, attenuato-fusiformi, albida, nitida; anfractibus octo, quorum  $3\frac{1}{2}$  apicales ochro-tincti, pulchre decussati, cæteris tumidulis, liris arctis longitudinalibus spiralibusque decussatis, liris interdum pallidule stramineo-tinctis,

\* *Amphitrite*, a sea-goddess, wife of Neptune.

† *Θυγάτηρ*, a daughter.

‡ *Θείος*, divinely beautiful.



nitidulis; apertura oblonga, labro tenui, sinu lato, haud profundo, canali brevi, lato, paullum producto.  
Long. 9.50, lat. 3 mm.

*Hab.* Persian Gulf, Sheikh Shuaib Island, 15 fathoms; Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

Most delicate and beautifully closely encircled with decussating liræ, a faint straw-coloured or golden tinge being sometimes observable on them. The specimens from the first locality mentioned are not so tumid on the body-whorl; we cannot, however, separate them, even varietally, from the typical form from the Gulf of Oman. This differs from *D. boholensis*, Reeve, not only in the fine decussations, but in the canal being more prolonged and greater tumidity of whorls.

*Daphnel'a buccinulum* \*, sp. n. (Pl. XXIII. fig. 9.)

*D.* testa ovato-rotunda, bucciniformi, delicata, alba, interdum pallido ochraceo-suffusa; anfractibus 7, quorum 3 apicales rufi vel straminei, tenuissime decussati, cæteris arcu et delicate obliqui-cancellatis, ad suturas impressis, tumidis, inflatis, ultimo anfractu pyriformi; apertura oblonga, labro tenui, sinu indistincto, marginè columellari excavatulo.

Long. 7, lat. 3.75 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $54^{\circ} 56' E.$ , 156 fathoms.

An inflated Buccinoid species, very delicate and beautifully cancellate throughout, which occurred not uncommonly at the above station in company with so many other, mostly minute, but hitherto unknown mollusks.

*Daphnella epicharta* †, sp. n. (Pl. XXIII. fig. 10.)

*D.* testa minuta, subpellucida, tenui, oblongo-fusiformi, nitida, alba vel obscure stramineo-diffusa; anfractibus 6, quorum apicales 3 delicatissime sub lente decussati, cæteris paullum ventricosi, fere lævibus, sed irregulariter spiraliter tenuissime liratis, ultimo anfractu interdum apud medium lævi; apertura angusta, oblonga, labro fere recto, incrassato, albo, nitido, intus simplici; columella recta, canali brevi, sinu perobscurato.

Long. 5, lat. 1.75 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58' N.$ , long.  $56^{\circ} 54' E.$ , 156 fathoms.

A minute but puzzling form. The sinus and other Pleurotomid characters are so slightly expressed that it might at

\* *Buccinulum*, dim. of *Buccinum*, from the resemblance.

† ἐπίχαρος, pleasing.

first sight be considered an *Æsopus*, or even an *Olivella*. The delicate decussation of the apical whorls shows the true relationship. It is somewhat frequent at the above station. Some examples are almost smooth, the apical liræ being more or less obsolete.

*Daphnella hedyæ* \*, sp. n. (Pl. XXIII. fig. 11.)

*D. testa* fusiformi, pallide castaneo-brunnea, apicem versus, simul ac ad basim delicate puniceo-tincta; anfractibus novem, quorum  $3\frac{1}{2}$  subhyalini, castaneo-punicei, minutissime decussati, tribus his proximis variciferis, tribus ultimis rotundatis, tumidulis, undique arcissime et pulchre decussatis, ad juncturas gemmuliferis, gemmulis microscopicis, nitidis, supra, infra suturas, spiraliter castaneo-maculatis, ultimo anfractu dorsaliter obscure bizonato; apertura oblonga, labro crassiusculo, intus lævi, sinu haud profundo, canali paullulum ad basim reflexo, puniceo tincto.  
Long. 14, lat. 5 mm.

*Hab.* Persian Gulf, Sheikh Shuaib Island, 15 fathoms.

Though at first sight this little species seems to present a familiar appearance, it is really distinct from any species hitherto recognized. Compare it with *D. patula*, Reeve, for instance: the chestnut markings are more or less similar, but the whole texture of the shell is distinct, the minute gemmuliferous decussation, the elegant rounded whorls, the smallish oblong aperture presenting notable points of difference.

*Daphnella Euphrosyne*, sp. n. (Pl. XXIII. fig. 12.)

*D. testa* attenuata, gracili, albida, tenui; anfractibus decem, quorum quatuor apicales castaneo-suffusi, minutissime decussati, cæteris ventricosulis, undique spiraliter arcete liratis, liris gemmuliferis, nitidis, inæqualibus, numero ultimum apud anfractum tres et viginti; apertura anguste oblonga, labro tenui, sinu haud profundo, canali apud basim producto, lato.  
Long. 15, lat. 4 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

Doubtless allied to *D. boholensis*, Reeve, but possessing two more whorls, while it is more graceful and attenuate throughout; peristome not so effuse, canal more prolonged, and spiral liration more distinct and regular. Again, it differs in its beaded liration from any form of *D. avis*, Reeve, which it resembles in form, and which also occurs in the same seas. Were it not for the absence of columellar plication, it would more than resemble a *Mitra* of the subgenus *Cancilla*.

\* ἡδύς, sweet.

The peculiar beauty well merits for it the specific name proposed, of one of the three Graces.

*Cythara elegantissima*, sp. n. (Pl. XXIII. fig. 13.)

*C. testa* pergracili, fusiformi, albida; anfractibus 6, quorum 2½ apicales obtusi, plani, minute sculpti, cæteris supra medium tenuiter angulosis, dein rectis, undique longitudinaliter rudiliratis, liris inconspicuis, spiraliter liris crassioribus succinctis (in ultimo circa 14); apertura anguste oblonga, intus alba, labro sinu lato, haud profundo, incrassato; columella fere recta, basi prolongata.

Long. 8, lat. 2.50 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms. Also lat. 25° 30' N., long. 57° 30' E., 88 fathoms, mud.

A very elegant form, as implied by the specific name, with markedly obtuse apex, probably not quite full-grown. The coarse longitudinal lineæ, crossed by more distinct but equally rough spirals, are characteristic. Very rare. Since description, another example has been procured, with perfect thickened lip, sinus broad and shallow.

*Cancellaria (Trigonostoma) lusciniæ*\*, sp. n.  
(Pl. XXIII. figs. 14, 15.)

*C. testa* parva, attenuato-fusiformi, tenui, albida, vel pallide olivaceo-straminea; anfractibus septem, quorum tres apicales tumidi, vitrei, perlæves, cæteris longitudinaliter irregulariter sed arcte costatis, ad suturas excavatis, costis crassiusculis, undique transversim tenuiliratis, liris tenuibus superficiem totam circumambientibus; apertura oblongo-ovata, margine columellari triplicato. Long. 11, lat. 4 mm. (sp. maj.).

*Hab.* Arabian Sea, lat. 18° 58' N., long. 71° 45' E., 40 fathoms.

This is the little species alluded to by us in our former paper as having been dredged near Bombay, as above, in April 1901. It is allied to *C. macrospira*, Ad. & Rve., but much smaller in every detail. The shell is attenuately spindle-shaped, thin, either translucent white or pale straw-olive, seven-whorled, the three uppermost whorls being glassy, globular, and swollen, the remaining three or four closely but irregularly ribbed, somewhat excavate, as are nearly all the section *Trigonostoma* of *Cancellaria*, suturally. The transverse lineæ surmount the ribs and are not interrupted. The columella is thrice-plaited.

\* *Luscinia*, a nightingale.

*Kleinella sympiesta*\*, sp. n. (Pl. XXIII. fig. 16.)

*K. testa perforata, rotundato-ovata, alba, obesa, compressa; anfractibus 5, quorum  $1\frac{1}{2}$  apicales vitrei, perlæves, cæteris apud suturas gradatulis, ventricosis, undique delicate decussatis, interstitiis quadratulis; apertura ovato-lunari, labro paullum incrassato, margine minute crenulato, supra late excavato.*

Long. 5, lat. 3.50 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Only two species, of which the best known is *K. cancellaris*, A. Ad., from Corea and Japan, have hitherto been described of this genus, and to these we venture now to add a third. Undoubtedly they have a close family affinity to each other: the *K. sympiesta* may be known by its particularly obese and compressed form and tumid body-whorl; the umbilicus is deep and the outer lip minutely crenulate on the margin.

Judging alone from conchological grounds, the animal being absolutely unknown, we should assign to this genus a place near *Actæon*, Montf., and not, as suggested by some authors, consider it one of an outlying group of the Pyramidellidæ. Indeed, were it not for the total absence of the columellar plicæ, we should regard it as a member of the genus just mentioned (*Actæon*).

*Cylichna (Mnestia) bizona*, A. Adams.  
(Pl. XXIII. fig. 17.)

*Bulla (Cylichna) bizona*, A. Ad. in Sowerby, Thes. Conch. pt. 11, vol. ii. p. 595, pl. cxxv. fig. 148.

*Hab.* Gulf of Oman, Maskat, 15 fathoms.

A large local form (alt. 7, diam. 3 mm.), which we figure, as contrasting with the Chinese examples in the Cumingian collection and with others. It is a species of wide distribution, being reported from China, Singapore, Fiji, and Torres Straits.

*Cylichna jecoralis*, sp. n. (Pl. XXIII. fig. 18.)

*C. testa oblongo-cylindrica, delicata, apud basim paullum effusa, apice imperforato, plicato, subhyalina, superficie lævi, nitida, antice posticeque spiraliter striata, pallide livido-olivacea; apertura pyriformi, supra angusta, intus cinerea, labro paullum effuso, tenui; columella obscurissime plicata.*

Alt. 11, diam. 5 mm.

*Hab.* Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

\* συμπίεστος, compressed.



Without a knowledge of the anatomy of these small species of Tectibranchs it is often mere guesswork assigning them to generic positions. This species, however, seems best located in *Cylichna*, in our opinion. It is a delicate, moderate-sized species, of a peculiar hepatic tint, this suggesting the proposed specific name.

*Retusa omanensis*, sp. n. (Pl. XXIII. fig. 19.)

*R.* testa parva, cylindrica, albo-lactea, subhyalina, tenui, supra truncatulo, apice fere immerso; anfractibus 3, supra excavatulis, marginibus apud suturas acutis, prominulis, superficie omni spiraler sub lente delicatissime striata; apertura postice latiore, oblonga, antice angusta, labro recto, ad basim rotundata; columella obscure uniplicata, margine paulum incrassato.

Alt. 4, diam. 1.75 mm.

*Hab.* Gulf of Oman, lat.  $24^{\circ} 58'$  N., long.  $56^{\circ} 54'$  E., 156 fathoms.

A most delicate and minute species, of the same character as *Utriculus complanatus*, Watson, from Papua ('Challenger' Rep. xv. p. 650, pl. xlviii. fig. 9), but that species is longitudinally striate. We follow Pilsbry (Man. Conch. xv. p. 203) in the nomenclature, and would refer to his reasons for the substitution of *Retusa*, Brown, 1827, for the more familiar *Utriculus*, Brown (in parte), 1844, non Schumacher, 1817.

*Atys flavovirens*, sp. n. (Pl. XXIII. fig. 20.)

*A.* testa ovata, in medio tumida, utrinque producta, tenuissima, subdiaphana, pallide flavo-virente, apud medium lævi, nitida, antice, simul ac postice, spiraler paucistriata, apice plicato, labro tenui, paulum effuso; apertura anguste lunari; columella uniplicata.

Alt. 7, diam. 3 mm. (sp. maj.).

*Hab.* Gulf of Oman, Maskat, 15 fathoms.

Allied to *A. tortuosa*, A. Ad., from the Philippines and Torres Straits; the shell is smaller, and more green than yellow-tinged. Mouth narrower, the anterior as well as the posterior striæ being fewer and less pronounced. Many examples.

*Mathilda carystia*\*, sp. n.

*M.* testa gracili, fusiformi, eleganter attenuata, brunnea, brunneo-nigra, vel, imprimis, castanea; anfractibus 12-13, quorum apicalis heterostrophus, pervitreus, globularis, cæteris apud suturas impressis, binis præcipuis lævibus carinis præditis, sex vel septem

\* *κάρυον κάρύστιον*, from the chestnut colour.

ultimis ter minoribus asperis, omnibus acutis, prominulis, interstitiis quadratulis, ultimo anfractu 9-carinato, quorum tres circa peripheriam maxime conspicui; apertura fere rotunda, labro tenui, crenulato; columella alba, crassiuscula, recta, nitida.  
Long. 12, lat. 3 mm.

*Hab.* Persian Gulf, Koweit, 10 fathoms, mud and sand.

A very select species, having the vitreous heterostrophe apex so characteristic of the genus; turritelloid in shape, elegantly attenuate, the upper whorls with two principal carinæ and three lesser keels, the lowest whorl nine-keeled, of which three, at the periphery, are the most important. The quadrated spaces at the interstices, and liræ extending longitudinally over the lower carinæ, have a beautiful effect as regards the sculpture. The colour is either pale chestnut, dark chestnut, brown, or blackish. The two other species from the same region, *M. gracillima* and *zmitampis*\* (of which the latter has since occurred in the Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms), differ in size, colour (both being white), and, in the case of *M. gracillima*, in squareness of aperture. A general family likeness, however, pervades all the members of this exquisite genus. This new species, and also the next, will be figured subsequently.

*Solarium (Torinia) admirandum*, sp. n.

*S.* testa parva, depresso-discoidali, late perspective umbilicata, alba, delicata; anfractibus quatuor, quorum apicalis profunde submersus, huic proximus vitreus, tumescens, lævis, cæteris depressis, pulcherrime sculpturatis, juxta suturas spiraliter carinatis, dein tribus liris minoribus, cum carina fortissima spirali exteriori succincta, inter quam et peripheriam lira minore interposita, peripheria quam maxime acuta, pulchre et minute echinulata, ultimo subtus ad basim imprimis sulco forti, dein duabus vel tribus carinis spiralibus conspicuis prædito, carina supra umbilicum, sicut peripheriali, pulchre sculpturata et echinulata, umbilico ipso simili modo echinulis minoribus decorato; apertura rotunda, peristomate tenui, carina peripheriali ad medium conspicua.

Alt. 1.20, diam. 3 mm.

*Hab.* Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Among very numerous examples of *S. homalaxis*, Melv., which appears frequent from Bombay northwards, three specimens occurred of a far more select form, which is now described. Its sculpture is most elaborate, the very acutely

\* Proc. Zool. Soc. 1901, vol. ii. pp. 379, 380, pl. xxii. figs. 18, 19.

keeled periphery, bordered (as is the inner basal keel surrounding the umbilicus) with short mucronate crenulations, is most distinctive. The two species of *Homalaxis* found in the same dredging, and described earlier in this paper, are of a similar texture and bizarre sculpture, especially as regards the aforesaid carinal ornamentation.

With regard to the Mollusca treated of in this paper, it will be well to state that four types are in the collection of Mr. E. R. Sykes, viz. *Rissoina registomoides*, *Eulima 10-gyra*, *Fluxina Dalliana*, and *Clathurella Sylkesii*. All the rest, with co-types of the last two just mentioned, will be placed in the British Museum (Natural History).

# EXPLANATION OF THE PLATES.

## PLATE XX.

- Fig. 1. *Emarginula undulata*.
- Fig. 2. — *Camilla*.
- Fig. 3. *Cyclostrema henjamense*.
- Fig. 4. — *supremum*.
- Fig. 5. — *annellarium*.
- Fig. 6. — *prominulum*.
- Fig. 7. — *euchilopteron*.
- Fig. 8. *Liotia romalea*.
- Fig. 9. — *echinacantha*.
- Fig. 10. *Enida persica*.
- Fig. 11. *Euchelus Townsendianus*.
- Fig. 12. *Solariella zacalles*.
- Fig. 13. *Calliostoma thrincoma*.
- Fig. 14. *Leptothyra rubens*.
- Fig. 15. *Trichotropis pulcherrima*.
- Fig. 16. *Solarium* (*Torinia*) *cerdaleum*.

## PLATE XXI.

- Fig. 1. *Solarium abyssorum*.
- Fig. 2. *Fluxina Dalliana*.
- Fig. 3. *Homalaxis rotula-catharinaea*.
- Fig. 4. — *cornu-Ammonis*.
- Fig. 5. *Cerithium verecundum*.
- Fig. 6. *Scissurella ætheria*.
- Fig. 7. *Fossarus* (*Couthouyia*) *unicarinalis*.
- Fig. 8. *Adeorbis axiotimus*.
- Fig. 9. *Erato recondita*.
- Fig. 10. — —, var. *haplochila*.
- Fig. 11. *Eulima decagyra*.
- Fig. 12. *Rissoina isosceles*.
- Fig. 13. — (*Zebina*) *registomoides*.
- Fig. 14. *Eulimella carmanica*.
- Fig. 15. *Pleurotoma* (*Gemmula*) *navarchus*.

## PLATE XXII.

- Fig. 1. *Syrnola mussandamica*.
- Fig. 2. *Mormula persarum*.

- Fig. 3. *Actæopyramis lætitia*.  
 Fig. 4. — *brevicula*.  
 Fig. 5. *Pyrgulina manoræ*, Melv., var.  
 Fig. 6. *Scala (Constantia) intertexta*.  
 Fig. 7. *Nassa (Alectryon) limerocessa*.  
 Fig. 8. *Tritonidea Sowerbyana*.  
 Fig. 9. *Metula daphnelloides*.  
 Fig. 10. *Murex (Ocinebra) Marjoriæ*.  
 Fig. 11. *Peristernia corallina*.  
 Fig. 12. *Mitra (Costellaria) diaconalis*.  
 Fig. 13. *Marginella (Glabella) alchymista*.  
 Fig. 14. *Terebra helichrysum*.  
 Fig. 15. *Drillia dives*.  
 Fig. 16. — *philotima*.  
 Fig. 17. — *continua*.  
 Fig. 18. — *granatella*.  
 Fig. 19. *Clathurella opsimathes*.  
 Fig. 20. *Drillia lithoria*.

## PLATE XXIII.

- Fig. 1. *Drillia audax*.  
 Fig. 2. *Daphnella nereidum*.  
 Fig. 3. — *Amphitrites*.  
 Fig. 4. *Clathurella Sykesii*.  
 Fig. 5. *Mangilia comideleuca*.  
 Fig. 6. *Daphnella thygatrica*.  
 Fig. 7. *Clathurella guisquilua*.  
 Fig. 8. *Daphnella thia*.  
 Fig. 9. — *buccinulum*.  
 Fig. 10. — *epicharta*.  
 Fig. 11. — *hedyæ*.  
 Fig. 12. — *Euphrosyne*.  
 Fig. 13. *Cythara elegantissima*.  
 Figs. 14, 15. *Cancellaria (Trigonostoma) lusciniæ*.  
 Fig. 16. *Kleinella sympiesta*.  
 Fig. 17. *Cylichna (Mnestia) bizona*, A. Ad., var.  
 Fig. 18. — *jecoralis*.  
 Fig. 19. *Retusa omanensis*.  
 Fig. 20. *Atys flavovirens*.

## XXVII.—On new Species of Lycænidæ from West Africa.

By GEORGE T. BETHUNE-BAKER, F.L.S., F.Z.S.

I HAVE been working out a collection of Lycænidæ made in the neighbourhood of Sierra Leone by my friend Mr. D. Cator in the years 1901 and 1902, and among them are several new species, which I describe here; the types are all in Mr. Cator's collection, which for the time being is in my possession. There is also an *Acræa* which I cannot trace has been described as yet, and which is in the National Collection unnamed.



*Acræa igola leonina*, subsp. n.

♂. Upperside: primaries hyaline, very slightly tawny (yet hyaline) over the cell and inner marginal area, beyond the middle of the cell a very slight trace of a darkish spot; apex and posterior margin broadly dusky. Secondaries reddish, with decidedly broad blackish margin; all the veins dusted with black nearly up to the cell, and between each of the veins a dark longitudinal dash of blackish nearly equal in length to the dusting just mentioned; a row of four black basal spots below each other, followed by a similar row of five spots, the one in the cell being shifted slightly basewards, beyond which is a row of three spots slightly curved and rather larger, beginning with one in the cell and reaching to the internal vein; beyond this is a straight row of three spots, the first on the costa, the second at the upper extremity of the cell, and the third below the cell in the angle formed by the first median vein; these spots are plainer on the underside than on the upperside. Beneath, the primaries are very shining; the apex and the posterior margin are yellowish, the short dusky dash between the veins being much plainer than on the upperside: secondaries much paler and shining, the dusky veins and dashes showing through more distinctly.

♀. Upperside: primaries hyaline, but altogether duskier than in the male: secondaries as in the male, but duskier; spots as in the male, but with the addition of one very small spot immediately below the second one of the last row. Underside: the difference in both wings is just the same as in the male.

Exp. alar., ♂ ♀, 56 millim.

This subspecies was taken in November, January, and again in June. It differs from *igola* in that the whole of the primaries are hyaline, with barely a trace of the tawny red. On the secondaries the arrangement of the spots differs, and *igola* lacks the broad dusting of the veins.

*Pentila septistrigata*, sp. n.

♂. Upperside: both wings white. Primaries with a broad dark costa and a very broad, dark, irregular apical area extending from just in front of the cell on the costa to rather lower than the third median vein on the posterior margin, with no spots or other marks. Secondaries with a distinct fine dark margin from the anal angle to the third median vein on the posterior margin; otherwise without any marks, except

that the transverse stripes of the under surface show through. Underside: primaries with a narrow stripe of brown along the upper margin of the cell, beyond which is a short, curved, pale brown stripe from the costa to near the base of the fifth median nerve; rising just beyond this on the costa is another transverse, curved, brown stripe, ending above the third median nerve near the posterior margin; both these curved stripes are a little indefinite interiorly; beyond the latter stripe is a sharply defined, darkish brown, scalloped, narrow, submarginal stripe, following nearly the same course, but ending below it on the second median nerve; beyond this is a marginal stripe parallel with it, but interrupted by the veins. Secondaries with six transverse brown lines, four of which extend from the submedian vein to the costa, the first three parallel with each other and the second three with each other, followed by a curved, scalloped, submarginal stripe from the apex to the anal angle, parallel with the fine dark line on the posterior margin; the third of the basal transverse lines does not extend to the costa, but ends near the upper margin of the cell, whilst the third of the second series ends on the fourth median vein; fringes white, intersected by a brown line; palpi yellow. Antennæ black, ringed with white and tipped with yellow; legs yellow, ringed with black; thorax and abdomen white.

Exp. alar. 34 millim.

This species may possibly prove to be a local race of *Ferrymani*, Grose-Smith, but it could be separated at a glance. Both wings are very much narrower; the primaries of my species also have scarcely any black on the costa, whilst *Ferrymani* has it extending well over more than half the cell and beyond it; whilst the black posterior margin of Grose-Smith's species extends more than three-quarters its length, but in my species not more than halfway down. The underside differs likewise. In the primaries the black patch in the cell by the costa and the marked black curved fascia is replaced in my insect by a slight brown streak and an indefinite pale brown slight fascia. In the secondaries the transverse brown lines are not half the width of those in "*Ferrymani*," and none of them are joined together, whilst in Mr. Grose-Smith's insect all the stripes are connected by the costa, and they are also very dark and quite different in colour to the pale brown of *septistrigata*.

This species is not common, but cannot be called rare, in Sierra Leone in February and in June and July. Specimens are in both Mr. Cator's collection and my own, the type being in Mr. Cator's.

*Micropentila Dorothea*, sp. n.

♂. Upperside: both wings black, with tessellated black and white fringes. Primaries with a whitish spot in the cell near its upper extremity, below which near the submedian vein is a second; two thirds the length of costa and just below it are two whitish spots close together, between the second and third median veins beyond their middle is another whitish spot. Secondaries with a distinct whitish spot between the second and third median veins near their source, below which is another spot bisected by the first median vein; this is followed by a third larger spot between the submedian and inner marginal veins; on the costa is also a trace of another spot near the apex; these spots have the appearance as though they should form part of a curved row or fascia in spite of their isolation. Underside: both wings blackish brown. Primaries with inner margin lighter; three cream-coloured spots in the cell and one just beyond it; a spot above and below the cell at the base of the wings; on the costa a spot over the third cell-spot and another over the one beyond it, followed by larger twin spots, which with two small spots and a third larger one form a slight, curved, transverse fascia; on the costa are two more small spots horizontally placed, directly beyond which is a straight row of six spots below each other, forming a submarginal row; close to the posterior margin is a largish spot just below the uppermost median vein, between which and the discoidal vein is a smaller spot on the margin; there are traces of two other spots on the posterior margin near the anal angle; all the spots are cream-coloured. Secondaries covered with numerous cream-coloured spots; a series of three basal spots below each other, followed by a curved row of four from the costa to the inner margin across the middle of the cell; this is followed by a third curved row of four or five spots across the end of the cell from the costa to near the inner margin, the second of which lies in the extremity of the cell and is followed by another spot beyond the cell; yet a fourth curved row of large irregular spots lies beyond, followed by a distinct row of eight small spots from the apex to the anal angle, one between each vein, those at the anal angle being larger than the others; beyond these are two larger marginal spots just below the apex and three or four spots or dashes near the anal angle on the posterior margin. Head, thorax, and abdomen black; palpi cream-coloured, end joint black; legs black, ringed with cream-colour.

Exp. alar. 32 millim.

This species, which is not uncommon, flying from January to March in Sierra Leone, is near *M. adelgunda*, Staud., but differs in that it has three spots in the cell in both wings and one beyond it; this is quite constant in all the specimens before me. Both primaries and secondaries are also broader and fuller than in Staudinger's species.

I dedicate this species to Mrs. Cator, who captured the first few specimens, thus discovering its locality, around which it appears to keep very closely.

*Phytala elais Catori*, subsp. n.

♂. Upperside: both wings pale somewhat shining blue. Primaries with a broad, velvety black, apical area and posterior margin, extending as a wedge-shaped patch along the costa to a third its length; the posterior margin decreases in width rapidly from the third median vein, where it is widest, to the inner angle; a large wedge-shaped patch, terminating in a quadrangular one, invades the blue of the wings along the upper margin of the cell, extending well beyond it; at the base of the inner margin is a large sex-mark, the submedian vein in the sex-patch being considerably swollen; the costal base of the wings is black. Secondaries with a very broad brown costa, the posterior margin being much narrower and tapering to little more than a broad line; the inner margin is broadly brown. Underside as in *P. elais*, Doubl.

♀. Entirely dull brown, with a very pale mauve oblique patch beyond the cell extending from the costal to the third median vein. Underside similar to the male, but duller, paler, much more ochreous, and it is without any lustre.

Exp. alar. 70 millim.

This species is, I believe, a local race of *elais*, Doubl., but may be recognized at a glance by the large black patch invading the blue area beyond the cell, which is quite absent in Doubleday and Hewitson's species. In this form it is quite constant. I have five specimens before me, whilst Mr. Cator has caught many more since his return; he tells me the black patch is markedly present in all. It flies from December to March.

*Phytala leonina*, sp.n.

♂. Primaries velvety black, with two or three small ill-defined blue transverse spots beyond the cell; the area between the cell and submedian vein bright palish blue, and half of the area between the first and second median veins the



same colour. Secondaries velvety black, the whole of the area between the fifth median and the internal vein being bright blue, the posterior margin being narrowly black. Underside: both wings a peculiar shiny slaty grey. Primaries with the lower half to the inner margin sooty black, in which near the anal angle are two good-sized grey indefinite marks, the lower one being the larger. Secondaries with a very indistinct trace of a submarginal row of greyish crescentic marks, and a yet slighter trace of a pale narrow band nearer the cell.

♀. Both wings uniform dark brown; the primaries with a darker patch in the central area caused by the black patch of the underside showing through. Underside: both wings ochreous. Primaries with the central area from the base to nearly the posterior margin sooty black, the inner margin being pale grey; just beyond the cell at the upper edge of the black area are two small whitish spots. Secondaries with a faint trace of a submarginal row of paler spots, followed by a second equally faint nearer the cell.

Exp. alar., ♂ 34, ♀ 41 millim.

Occurring in February and June in Sierra Leone.

*Epitola albomaculata*, sp. n.

♂. Upperside: both wings pale sublustrous azure-blue. Primaries with blackish-brown costa to the cell and all the area above the fourth median vein; posterior margin very broadly blackish brown at the afore-mentioned vein, very rapidly decreasing to a fine margin at the anal angle. Secondaries with the costa dark brown, extending just into the cell and so straight to the posterior margin; posterior margin finely black, inner margin dark grey to the submedian vein. Underside: both wings greyish brown, more or less irrorated with grey and with various greyish spots. Primaries: cell grey, invaded by three large spots of the brown ground-colour; basal area of the first three median veins grey; a perpendicular fascia of five greyish spots to the first median vein, that near the costa small and indefinite, the other spots increasing considerably in size, beyond this a submarginal fascia of grey crescentic spots between each of the veins to the first median, followed by another similar marginal fascia only somewhat straighter. Secondaries with three transverse interrupted pale fasciæ across the wing at the base, across the middle of the cell, and across the end of the cell, beyond which is a transverse row of largish indefinite whitish spots from the costa to the submedian vein; between this row and the fascia across

the end of the cell are two large white costal spots below each other; the posterior margin has a double row of crescentic whitish marks as in the fore wings.

Exp. alar. 42 millim.

This species flies in March. It is nearest *E. cercene*, Hew., but differs in the very broad blackish costa and apical area. *Cercene* is blue nearly to the costa itself, whilst beneath my species is covered all over with whitish fasciæ and spots in quite a different form to the fairly regular and small pattern of Hewitson's insect.

*Epitola moyambina*, sp. n.

♂. Upperside: primaries black, suffused with lustrous azure-blue from the inner margin to subcostal vein, extending well beyond the cell and almost up to the posterior margin at the anal angle; at the end of the cell the blue is invaded by a small wedge of the black ground-colour. Secondaries greyish black, paler along the costa, suffused with azure-blue from the discoidal vein to the second internal vein and extending nearly to the posterior margin, leaving a broadish black border thereto; fringes tipped with white at the apex. Underside: both wings greyish brown, tinged with a very slight purplish tint, with various greyish-white markings. Primaries with a short line of grey scales across the cell close to its end, below which is a double V-shaped mark, beyond which is another V-mark placed horizontally, below which is a larger patch of grey scaling; beyond this is a submarginal curved fascia of crescentic marks from the costa to the inner margin, one between each vein. Secondaries with three grey lines across the cell at the base, the centre, and near the end; above and below the latter are other similar short marks, forming a very interrupted transverse line across the wing; below the cell are a few scattered grey scales; there is a submarginal fascia of crescentic marks as in the primaries from the costa to the inner margin, and between this and the end of the cell is a very slight trace of a row of five or six indistinct spots, the two near the costa being the largest and best defined.

Exp. alar. 44 millim.

I have before me specimens taken in November and February; it will follow *E. cercene*, Hew., but differs from it in having less blue on both wings, the borders being much broader; *cercene* is blue in the secondaries up to the posterior margin, but my species has a broadish black border. Below my species has much less pattern and fewer marks, whilst the fasciæ that are present are much more distinct.

*Epitola nigra*, sp. n.

♂. Upperside: both wings uniform dark blackish brown; primaries with a slight blue scaling at the lower extremity of the cell in the submedian area, and also between the first and second median veins; secondaries spotless. Underside: both wings uniform dull greyish brown without any pattern at all; primaries with a suffusion of black over the central area of the wing from the base to the posterior margin.

♀. Upperside: both wings uniform brown, not very dark, quite spotless. Underside: both wings pale ochreous; primaries with the black suffusion as in the male, at the upper extremity of which is a trace of a pale spot; secondaries spotless.

Exp. alar., ♂ 41, ♀ 43 millim.

This species, which flies in February, will come next to *E. pinodes*, H. H. Druce, from which it differs in having no blue whatever on the upper surface of the secondaries. *Iinodes* has blue suffused all over the wing.

*Deudorix Catori*, sp. n.

♂. Upperside: both wings black, suffused all over with rich sublustrous cobalt-blue. Primaries with the costa black to the subcostal vein; apex black and posterior margin black, broader near the apex, decreasing rapidly to a line at the inner angle. Secondaries, tail and lobe black; sex-patch at the base of costa small and black. Sexual tuft of the primaries black. Underside: both wings pale grey, with the usual *Deudorix* quadrangular mark at the end of the cells, beyond which is a waved transverse yellow line finely edged outwardly with white, extending right through both wings, followed by a similar interrupted submarginal line, ending in the secondaries in the upper of the two anal ocellated spots. In the secondaries the first line is W-shaped over the anal spots, both of which are velvety black, the upper one ringed broadly with yellow except on the posterior edge, which is whitish; the lower one, *i. e.* the lobe-spot, is edged internally with blue scales, above which is a yellow stripe edged with black on each side.

Exp. alar. 32 millim.

This species, which flies in January, is unlike any *Deudorix* that I know; its linear markings remind one rather of *Hypolyccena* than of *Deudorix*; the neuration, however, is that of the latter genus.

*Lycænesthes subnitens*, sp. n.

♂. Upperside: both wings blackish. Primaries with the inner margin covered for the basal three quarters of its length with shining deep violaceous-blue scales extending slightly into the cell. Secondaries with the discoidal area and half of the median area covered with the same coloured shining scales; this lustrous area is of a peculiarly deep tone of colour, and at a certain angle is hardly visible. Underside: both wings blackish brown, with various spots and marks defined by white lines. Primaries with a triangular dark mark near the base, edged laterally with white, followed by a broadish irregular dark band inclined in the opposite direction, as the two sides of an  $\Delta$ , edged with white; beyond this a transverse fascia from the costa, angled above the third median vein, whence it rapidly tapers to a point touching a largish spot in the inner angle, both the fascia and the spot being edged with white; from near the apex there is a submarginal band confluent with the afore-mentioned spot, edged with white, a fine dark marginal line; extreme posterior margin itself white, intersected at the veins. Secondaries with a broad basal laterally white-edged mark, which appears confluent with the triangular mark of the primaries; beyond this and adjoining it is another irregular curved fascia, edged with white all across the wing; touching this on the costa is a large spot, below which is a large double spot projected outwards, below which is another double spot projected inwards, adjoining an angled spot on the inner margin; outside this row of spots is a submarginal band, followed by a marginal row of white spots pupilled with blackish, two black anal spots more or less irrorated with metallic scales, the upper one with a deep orange-coloured iris.

Female precisely like the male above and below, the only difference being that the lustrous blue area of the primaries is a much greyer blue though not less shining.

Exp. alar., ♂ ♀, 22 millim.

This species, which flies in January, is nearest *L. Staudingeri*, S. & K., but the blue of the primaries is much less in extent, deeper in colour, and more lustrous, whilst *Staudingeri* has no blue at all on the secondaries.

*Lycænesthes Marshalli*, sp. n.

♂. Upperside: both wings entirely brown. Secondaries with three very fine, shortish, white tails; posterior margin black, finely edged internally with white; on the margin between the lower median veins are four black spots edged with white, one between each two veins, the size of each increasing



towards the anal angle. Underside: both wings pale brown, almost entirely covered with white, with numerous dark brown marks and stripes. Primaries with a short, basal, dark, costal stripe and a dark triangular patch, beyond which is a broken dark stripe across the end of the cell, arising in a small costal spot; beyond this are two transverse costal fasciæ, the first one being angled and longer and broader than the second; between the angled fascia and the stripe crossing the cell is a broadish stripe extending from the fourth median vein to the submedian, and tapering rapidly to the latter; a broad submarginal stripe followed by a very fine one; posterior margin finely dark. Secondaries with two transverse, dark, broadish, basal bands, followed by three large dark spots across the wing, one on the costa, another across the cell, and the third on the inner margin, the latter being a double spot; outside these are two other large spots on the median area, beyond which is a broad curved dark stripe from apex right to the inner margin; at the anal angle is a small black spot followed by a short dash, another black spot with a yellow iris, above which is another small black spot; all of these have a slight scattering of metallic-blue scales; posterior margin itself finely dark.

Female like the male, but on the primaries there is a trace of two greyish spots, one on the posterior and one on the inner margin near the anal angle; whilst on the secondaries are two distinct rows of submarginal bluish-white spots roughly parallel with the posterior margin of the wing. On the underside there is decidedly more white, caused by the dark spots being smaller than in the male.

Exp. alar., ♂ 19–22, ♀ 23 millim.

This species, which I dedicate to Mr. G. A. K. Marshall who has done so much for entomology on the other side of Africa, flies in January, February, and June, and will come near *L. grammicus*, S. & K.; but it has not a marginal border of spots on either wings, as that species has on both wings, and the pattern beneath is very different, the underside pattern being between *grammicus* and the previous species here described, viz. *subnitens*.

*Lycænesthes leonina*, sp. n.

♂. Upperside: both wings brown. Primaries with a largish indefinite whitish patch at the end of the cell and in the median area, and a small blackish spot at the end of the cell; posterior margin darker than the rest of the wing. Secondaries with a small double black spot in the anal angle, followed by a larger one above it, above which is another, rather smaller; posterior margin finely dark brown,

internally edged with whitish. Underside: both wings pale ochreous grey. Primaries with a darker spot at the end of the cell, edged with whitish; beyond this is a transverse sharply angled row of large darker spots, preceded by indefinite white dashes and edged laterally with white; this row extends from the costa just beyond the middle to near the middle of the inner margin, and is angled outwardly; beyond this is a row of darker lunules indefinitely and indistinctly edged with whitish; posterior margin finely dark. Secondaries with a small dark spot on the costa near the base, followed by a larger one about the centre of the costa; at the end of the cell is a rather large darkish spot laterally edged with whitish and paler in the centre, below which is another similar spot touching the inner margin; from this spot arises a curved row of similar spots extending up to the lower outer edge of the second dark costal spot; beyond this is a submarginal row of lunules laterally edged with whitish, outside which is a marginal row of smaller but more definite similar lunules; posterior margin finely dark; anal angle with two small black spots, above which, between the first and second median veins, is a larger black spot margined internally with yellow; slight blue metallic scaling is scattered over these spots.

♀. Upperside like the male, except that there is no white patch on the primaries, though there is a slight indication of a paler brown patch, and in the secondaries the marginal spots at the anal angle are continued nearly up to the apex. The underside pattern is the same, but in both wings the transverse row of large spots is very broadly margined externally with white, and the lunular marginal row is larger and more distinct, whilst in the primaries the row of large spots instead of being sharply angled is only curved.

Exp. alar., ♂ 31, ♀ 32 millim.

This species, which was taken in January, is somewhere near *L. lycænoides*; but it is not white underneath as that species is, and the pattern is different.

XXVIII.—On the Distribution of Mid-water Chætognotha in the North Atlantic during the Month of November. By R. T. GÜNTHER, M.A., F.R.G.S.

[Plate XXIV.]

A REPORT on the Cœlenterata obtained by Mr. George Murray during the cruise of the 'Oceana' in November 1898 appeared in the 'Annals' for April last. The organisms

submitted to the author for examination had been captured by open plankton-nets towed in series at definite depths between the surface and a little over two miles. The final results of the examination of the material showed that, at any rate so far as the Cœlenterate fauna was concerned, Mr. Murray's method was very useful, and one which may be made to yield valuable results.

It was found that in the nets which had been towed in the deeper waters of the Atlantic were several species of *Medusæ* and *Siphonophora* which were absent from all the nets towed nearer the surface. *Aglantha rosea* was abundant in hauls from below 1000 fathoms, but only occurred in small numbers in the more superficial hauls.

The object of the present communication is to show that the distribution of Chætogonatha in the various nets leads us to similar conclusions and affords valuable confirmatory evidence that the dark intermediate waters of the ocean, into which the solar rays do not penetrate, are inhabited by a population of Chætogonatha which, during the month of November at all events, is much denser than the population of the upper strata, into which sunlight penetrates.

In the preparation of the accompanying Table (Pl. XXIV.), in which the results of the investigation are summarized, the method adopted was to measure the lengths of the individuals found in the various hauls separately, and to enter the results of a census of individuals grouped according to their length in the appropriate places in the Table.

It is thought that in this way a clearer and more trustworthy representation of one of the elements composing the Atlantic meso-plankton will be obtained, and that thus the main object of the expedition will be better served than by a more or less imperfect attempt at classifying damaged material by taxonomic characters of disputed value.

Among the species recognized were Dr. G. H. Fowler's new species of *Sagitta Whartoni*, to which the longest individual (47 millim.) is referable, and which seems therefore to be a species characteristic of the Atlantic meso-planktonic fauna. Many of the smaller individuals seemed to resemble *S. bipunctata*. As might have been expected, *Spadella hamata*, Möbius, was taken in great numbers in most of the nets, but we are not aware of any previous record of this species from so great a depth as 1700 fathoms.

The chief facts of the distribution of the oceanic Chætogonatha, which are clearly indicated in the accompanying Table (Pl. XXIV.), are, firstly, that the upper hundred fathoms contain but few individuals as compared with the

deeper waters of the Atlantic, and these few are small in size, being on the average less than 6 millim. in length.

Below 200 fathoms and down to 700 fathoms these small *Chætognatha* become very abundant (no less than fifty-five appearing in the 500-fathom net), and numerous individuals averaging about 12 millim. make their appearance, also a few large specimens of 20–28 millim. were taken in the deeper nets.

Then appears a break in the uniformity of the distribution. The four nets which were towed at depths between 800 and 1000 fathoms caught far fewer *Chætognatha* than the nets above or below this zone, and although one large individual of 35 millim. was taken, those exceeding 10 millim. were not common.

All nets from below 1000 fathoms brought up abundant individuals averaging from 8 to 10 millim., as well as a fair number between 10 and 15 millim. Specimens of 20 to 32 millim. were more frequent than in the more superficial 1000 fathoms, and in the nets from 1400 and 1500 were taken two gigantic *Chætognatha* of 40 and 47 millim. respectively.

It appears, then, that whereas the distribution of the smaller *Chætognatha* (*i. e.* under 14 millim. in length) is fairly uniform throughout the intermediate waters of the North Atlantic in November, with the possible exception of a zone between 800 and 1000 fathoms, the larger forms are both more numerous and attain to a larger size in the deeper waters; for whereas but a single specimen (29 millim.) exceeding 26 millim. was captured in the nets towed above 800 fathoms, eighteen specimens were found in the nets towed at depths between 900 and 1700 fathoms.

#### EXPLANATION OF PLATE XXIV.

The figures in the first column give the depths in fathoms at which the nets were towed. The value of each of the spaces between the horizontal lines is 20 fathoms.

The numbers of the nets in the second column refer to the five stations at which the nets were lowered; they are:—

Nos. 1 b, c.	Lat. 52° 4'·5 N., long. 11° 20'·1 W.
2 a-g.	Lat. 52° 4'·5 N., long. 12° 27'·0 W.
4 a-l.	Lat. 52° 27'·6 N., long. 15° 40'·0 W.
5 a-l.	Lat. 52° 18'·1 N., long. 15° 39'·9 W.
6 b-h.	Lat. 52° 20'·0 N., long. 15° 7'·9 W.

The numerals in the body of the table show the number of individual *Chætognatha* of particular sizes captured by the nets indicated upon the same horizontal line.

The *length* (in millimetres) of the individuals is indicated by the figures



on the top line which stand vertically over the numerals in the body of the table.

An example will make this clear. At a depth of about 220 fathoms, in net numbered 6*b* were captured 16 individuals averaging 7·5 millim. in length. The extent of the *dark line* on either side of the figure 16 indicates that the 16 individuals varied from 6 to 9 millim. in length, but the average length is shown by the position of the figure 16 itself.

In another case, at a depth of 1500 fathoms, in net 4*j* were taken 50 *Chætognatha* varying in length from 7·5 to 11 millim., 2 of from 11·5 to 12·25 millim., and 7 individuals of the lengths indicated, of which the longest measured 47 millim.

The shaded areas serve to indicate the distribution of catches richest in individuals of particular lengths at a glance. They are graphic representations of the numbers, which have been drawn to an approximate scale.

XXIX.—*List of the Ostracoda collected by Mr. George Murray, F.R.S., during the Cruise of the 'Oceana' in 1898\*.*  
By Dr. GEORGE STEWARDSON BRADY, F.R.S.

Lat. 52° 4'·5 N.  
Long. 12° 27' W.

	No. of Net, &c.	
2 <i>b</i> .	Nov. 19.	270 fath.
		<i>Microconchæcia Clausii</i> ? Immature.
2 <i>c</i> .	"	270 fath.
		<i>Conchæcia magna</i> , Claus. Few.
		<i>Paraconchæcia spinifera</i> , Claus. 1.
2 <i>d</i> .	"	374 fath.
		<i>Conchæcia maxima</i> , B. & N. P. Few.
2 <i>e</i> .	"	464 fath.
		<i>Paraconchæcia oblonga</i> , Claus. Few.
2 <i>f</i> .	"	620 fath.
		<i>Conchæcia hyalophyllum</i> , Claus. 1.
		<i>Conchæcia imbricata</i> , Brady. 1.
		<i>Conchæcilla armata</i> , Claus.
		<i>Paraconchæcia oblonga</i> , Claus. Several.
2 <i>g</i> .	"	650 fath.
		<i>Paraconchæcia oblonga</i> , Claus. Several.

Lat. 52° 27'·6 N.  
Long. 15° 40'·0 W.

4 <i>a</i> .	Nov. 20.	Surface.
		<i>Conchæcia</i> sp. ? 1.
4 <i>b</i> .	"	790 fath.
		<i>Paraconchæcia spinifera</i> ?, Claus. 1.
4 <i>c</i> .	"	920 fath.
		<i>Conchæcia imbricata</i> . 1.
		<i>Conchæcia maxima</i> ?
		<i>Conchæcia</i> ? sp. 2 or 3.

\* The method of capture, by a number of open tow-nets in series, is described in Journ. Geogr. Soc. vol. xiii. no. 2, Feb. 1899.

	No. of Net, &c.	
4 d.	Nov. 20.	1065 fath. <i>Conchæcia striata</i> , Claus. Many.
4 e.	"	1170 fath. <i>Conchæcia maxima</i> , B. & N. Several. <i>Conchæcissa cucullata</i> , Brady. 1.
4 f.	"	1275 fath. <i>Conchæcia imbricata</i> , Brady. 2. <i>Conchæcia porrecta</i> , Claus. Many. <i>Microconchæcia Clausii</i> ? Several.
4 g.	"	1370 fath. <i>Conchæcia magna</i> ?, Claus.
4 h.	"	1470 fath. <i>Conchæcia imbricata</i> , Brady. 2. <i>Conchæcia spinirostris</i> , Claus. Several.
4 j.	"	1570 fath. <i>Conchæcia imbricata</i> , Brady. 1. <i>Conchæcia magna</i> , Claus. Several. <i>Conchæcissa cucullata</i> , Brady. 1.
4 k.	"	1670 fath. <i>Conchæcia striata</i> , Claus. Several. <i>Conchæcilla lacerta</i> , B. & N. 1. <i>Microconchæcia Clausii</i> ? Few.

Lat. 52° 18' 1 N.

Long. 15° 53' 9 W.

5 a.	Nov. 21.	Surface. <i>Conchæcia</i> ? <i>maxima</i> , B. & N. 1.
5 b.	"	500 fath. <i>Conchæcia hyalophyllum</i> , Claus. Many. <i>Conchæcia imbricata</i> , Brady. 3.
5 c.	"	810 fath. <i>Conchæcia hyalophyllum</i> , Claus. Many. <i>Conchæcia imbricata</i> , Brady. 1.
5 d.	"	950 fath. <i>Conchæcia hyalophyllum</i> , Claus. Many. <i>Conchæcia imbricata</i> , Brady. 1.
5 e.	"	1070 fath. <i>Conchæcia imbricata</i> , Brady. 1. <i>Conchæcia magna</i> , Claus. Many. <i>Conchæcia spinirostris</i> , Claus. 2 or 3. <i>Conchæcilla lacerta</i> , B. & N. 1. <i>Conchæcissa cucullata</i> , Brady. 3 or 4. <i>Paraconchæcia gracilis</i> , Claus. 3 or 4.
5 f.	"	1190 fath. <i>Conchæcia imbricata</i> , Brady. Several. <i>Conchæcia striata</i> ?, Claus. Several.
5 g.	"	1300 fath. <i>Conchæcia striata</i> , Claus. Several. <i>Cypridina</i> ? sp.
5 h.	"	1410 fath. <i>Conchæcia imbricata</i> , Brady. 1. <i>Conchæcia cucullata</i> , Brady. 2. <i>Microconchæcia Clausii</i> . 1. <i>Paraconchæcia gracilis</i> , Claus. Few. <i>Paraconchæcia inermis</i> , Claus. Several.

- No. of Net, &c.  
 5j. Nov. 21. 1510 fath.  
*Conchæcia hyalophyllum*, Claus. Many.  
*Conchæcia imbricata*, Brady. Several.  
*Conchæcia spinirostris*, Claus. Several.  
 5k. „ 1610 fath.  
*Conchæcia hyalophyllum*, Claus. Many.  
*Conchæcissa cucullata*, Brady. 1.  
*Microconchæcia Clausii*, var. *similis*? Several.  
 5l. „ 1710 fath.  
*Conchæcia imbricata*, Brady. 3.  
*Conchæcia porrecta*, Claus. Several.

Lat. 52° 20' N.

Long. 15° 7' 9 W.

- 6a. Nov. 22. 150 fathoms.  
*Conchæcia magna*, Claus. Many.  
*Conchæcia spinirostris*, Claus. Several.  
 6b. „ 230 fath.  
*Asterope*? sp. 1.  
*Conchæcia*? sp. 1.  
 6c. „ 310 fath.  
 (Immature forms.)  
 6d. „ 375 fath.  
 (Mostly immature and indeterminable.)  
 6f. „ 510 fath.  
*Conchæcia hyalophyllum*, Claus. Many.  
*Conchæcia imbricata*, Brady. Several.  
*Conchæcilla lacerta*, B. & N. 1.  
 6g. „ 560 fath.  
*Conchæcia hyalophyllum*, Claus. Several.  
*Conchæcia imbricata*, Brady. Several.  
*Conchæcilla lacerta*, B. & N. 1.

XXX.—*New African Mammalia of the Genera Petrodromus, Dendromys, Mus, and Lepus.* By OLDFIELD THOMAS.

I.—PETRODROMUS.

Among some further mammals presented to the National Museum by Commissioner Sir Alfred Sharpe, K.C.M.G., are some examples of a *Petrodromus* which, on comparison with the ordinary S. Nyasan *P. tetradactylus*, proves to be distinct. It may be called

*Petrodromus venustus*, sp. n.

Essential characters of size, skull, and structure of caudal hairs as in *P. tetradactylus*, but coloration different in several respects. Median dorsal area for a breadth of about  $1\frac{1}{4}$ – $1\frac{1}{2}$

inches clear pinkish buff, with a slightly vinaceous tone, the rump not becoming markedly more plumbeous; sides bright buff; under surface white, not soiled or buffy white, though the bases of the hairs are slaty. Face-markings as in *P. tetradactylus*, but the cheeks more buffy. Limbs coloured as in *tetradactylus*, though the light parts are rather whiter. Tail rather more abundantly haired; black above, all round for its terminal half and along a narrow median line below from its basal fourth; sides of its basal half dull buffy.

Skull apparently quite as in *P. tetradactylus*.

Dimensions of the type (measured in the flesh):—

Head and body 210 millim.; tail 132; hind foot (s. u.) 52; ear 29.

Skull: greatest length 53.5; greatest breadth 27.

*Hab.* North Nyasa. *Type* from Namwiwe.

*Type.* Female. B.M. no. 3. 4. 2. 4. Collected September, 1902, by Mr. McClounie, and presented by Sir Alfred Sharpe, K.C.M.G.

This pretty species differs from *P. tetradactylus* by its paler clearer colour, not darkening on the rump, its clear buffy sides, its dead white belly, and the fine black line which runs up the underside of the tail.

## II.—DENDROMYS.

### *Dendromys messorius*, sp. n.

A small species, without a dorsal stripe.

Size comparatively small. Fur close and velvety, not so long and soft as in certain other species; hairs of back about 4–5 millim. in length. Upper surface dull uniform fulvous (Ridgway's "cinnamon" with a leaning towards "clay-colour"); the back quite without any trace of a dark dorsal streak; sides lighter and more rufous. Under surface white, not very sharply defined laterally; the hairs white to their roots; a slight yellowish or fulvous suffusion in the white of the chest and inner side of hind limbs. Ears of medium size, well haired, dull fulvous brown, not markedly darker than the general body-colour. Limbs like back externally, like belly internally; upperside of hands and feet dull whitish. Tail more thinly haired than usual, brown above, rather lighter below.

Skull stoutly built in comparison with that of some of the larger species; supraorbital edges square; palatal foramina not conspicuously long; molars small and narrow.

Dimensions of type (measured in the flesh):—

Head and body 70 millim.; tail 82; hind foot (s. u.) 18; ear 12.



Skull: greatest length 21; basilar length 14·8; greatest breadth 11; nasals, length 7·6; interorbital breadth 3; palate length 8·7; diastema 5; palatal foramina 3·8; length of upper molar series 3·1, of  $m^1$  1·6.

*Hab.* Efulen, Bulu Country, Cameroons. Alt. 500 m.

*Type.* Female. B.M. no. 3. 2. 4. 24; original number 93. Collected 29th July, 1901, by Mr. G. L. Bates. Eight specimens.

The only other West-African *Dendromys*, *D. Pecilei*, M.-Edw., has a dark dorsal stripe, grey-based belly-hairs, and molars which, if their dimensions are correctly given\*, are proportionally larger than in any other species of the genus.

*Dendromys insignis*, sp. n.

A large species, with a broad dorsal stripe.

Size large. General colour above slightly more buffy than Ridgway's "raw umber"; sides clearer buffy, passing without line of demarcation into the dull creamy buff of the under surface, where the hairs are slaty grey for three fourths their length. No stripe on head, though the centre of the crown is very faintly darker. Dorsal stripe commencing at withers, very broad (over 4 millim.), black, and conspicuous. Ears large, brown. Limbs dull buffy on outer surface, whitish buffy on inner; hands and feet white. Tail long, well haired, brown above, white below.

Skull large, light, and papery; muzzle long; interorbital space narrow, smooth, and rounded; palatal foramina long.

Dimensions of the type (measured in skin):—

Head and body 83 millim.; tail 104; hind foot (s. u.) 21·5; ear "15."

Skull: greatest length 24; basilar length 17·8; greatest breadth 12; length of nasals 9·1; interorbital breadth 3·2; diastema 6·4; palatal foramina 5·2; length of  $m^1$  2·2; length of lower molar series (the upper imperfect) 3·5.

*Hab.* Nandi, British East Africa. Alt. 2000 m.

*Type.* Male. B.M. no. 99. 8. 4. 65. Original number 8. Collected 2nd May, 1898, and presented by F. J. Jackson, Esq. One specimen.

"Lives in old birds' nests" (*F. J. J.*).

This fine tree-mouse, which adds one more to the many East-African mammals discovered by Mr. F. J. Jackson, is one of the *D. mesomelas* group, and is readily distinguishable

\* Skull 21 millim.; upper molar series 4;  $m^1$  2·5 (Pousargues, Ann. Sci. Nat., Zool. iii. p. 386, 1896).

by its broad and conspicuous dorsal stripe. Its nearest geographical ally (*D. nigrifrons*, True, from Kilimanjaro) is characterized by having a well-marked coronal stripe in addition, besides being much smaller.

### III.—THE SUBSPECIES OF *MUS HYPOXANTHUS*, PUCH.

The British Museum now possesses a good series from the Gaboon and Cameroons of the handsome rat described by Pucheran as *Mus hypoxanthus*. Compared with these, examples from Unyoro (*Ansorge*) and Nandi (*Jackson*) indicate the existence of two well-defined subspecies of that animal.

The three may be briefly distinguished as follows:—

General colour dark ("sepia"), the rump dark rufous. Belly more or less washed with buffy .....	<i>Mus hypoxanthus</i> ,
General colour above as in <i>hypoxanthus</i> , but the belly pure sharply defined white ..	<i>Mus h. bacchante</i> , subsp. n.
General colour above pale (between "tawny olive" and "clay-colour"), the rump bright rufous. Belly edged laterally with buffy .....	<i>Mus h. unyori</i> , subsp. n.

#### *Mus hypoxanthus bacchante*.

Size and general characters of true *hypoxanthus*. Colour above dark, nearly approaching Ridgway's "sepia" or "olive." Rump more rufous, but less conspicuously so than in the other forms, and only for a comparatively small area. Sides greyish olive. Whole of under surface from chin to anus and inner sides of limbs pure sharply defined white, not edged laterally with buffy. Rufous nose-spot small, confined to the roots of the whiskers and not extending back to the eye. Fine hairs of ears rufous; no postauricular patch. Upper surface of hands brown, of feet rufous brown, but not so rufous as in true *hypoxanthus*. Tail almost naked, finely scaled, blackish above, rather paler below.

Skull very like that of true *hypoxanthus*, but rather smaller, with narrower and more parallel-sided interorbital region, more projecting anteorbital plate, palate ending level with hinder edge of  $m^3$ , with larger bullæ, and rather smaller molars.

Dimensions of the type (measured on the skin):—

Head and body 159 millim.; tail 170; hind foot (s. u.) 30; ear 21.

Skull: greatest length 38; basilar length 31.5; greatest breadth 18.7; nasal length 15; interorbital breadth 5.2;

palate length 17·5; diastema 10·5; palatal foramina 7·8; length of upper molar series 6·7.

*Hab.* Nandi, British East Africa. Altitude 2000 m.

*Type.* Male. B.M. no. 99. 8. 4. 66. Collected 22nd April, 1898, and presented by F. J. Jackson, Esq.

*Mus hypoxanthus unyori.*

Size and proportions as in the other two forms. General colour above pale (between "tawny olive" and "clay-colour"), coarsely lined with dark brown. Posterior back for nearly one third of the body bright tawny rufous. Under surface dull white on throat and chest; belly mesially white, edged with buffy laterally, or washed with buffy all over. Red nose-spot prolonged backward to surround eyes. Ears brown or rufous brown, a distinct fulvous postauricular patch. Forearms and wrists bright rufous; upperside of hands greyish or sandy. Outer side of hind limbs rich rufous like rump, the upperside of the feet also fulvous or reddish. Tail nearly naked; scales about 11 to the centimetre; blackish above, rather paler below.

Skull agreeing closely with that of *M. h. bacchante*, but rather narrower and more delicately built.

Dimensions of the type (measured in the flesh):—

Head and body 155 millim.; tail 185; hind foot (s. u.) 31; ear 20.

Skull: greatest length 37; basilar length 30; nasals, length 14·3; interorbital breadth 4·9; palate length 16·5; palatal foramina 7·1; length of upper molar series 6·9.

*Hab.* Fadjas, on Victoria Nile, Unyoro.

*Type.* Male. B.M. no. 2. 11. 1. 28. Collected 18th July, 1897, by Dr. W. J. Ansorge. Six specimens.

"Tree-rat" (*W. J. A.*).

#### IV.—THE COMMON HARE OF CENTRAL CAPE COLONY.

Among the fine collection of mammals from Deelfontein collected during the war by C. H. B. Grant, and presented to the National Museum by Col. A. T. Sloggett, there occurred a good series of the local representative of *Lepus capensis*. As no typical Cape material was available for comparison, opportunity was taken for Mr. Grant to obtain a Cape hare from near Capetown itself during a collecting-trip arranged by Mr. C. D. Rudd.

This Cape specimen, in conjunction with the others in the Museum, shows, as might well be expected from the difference

in altitude, that the Deelfontein hare is sufficiently distinct from the Cape one to need subspecific distinction.

It may be called

*Lepus capensis centralis*, subsp. n.

Size and proportions of true *Lepus capensis*.

General colour strongly suffused with pinkish buff, instead of being nearly pure grey. Sides more strongly rufous and lateral parts of under surface very strongly washed with reddish vinaceous, as are also the throat and chest. Nape "vinaceous buff," instead of dull grey; ear-fringes more buffy; chin, throat, and limbs all more strongly rufous.

Dimensions of the type (measured in the flesh):—

Head and body 440 millim.; tail 94; hind foot (s. u.) 110; ear 122.

Skull: greatest length 84.5; basilar length 67.

*Hab.* Deelfontein, Cape Colony. Alt. 1400 m.

*Type.* Female. B.M. no. 2. 9. 1. 100. Original number 165. Collected 12th March, 1902, by C. H. B. Grant, and presented by Col. A. T. Sloggett.

The true Cape hare is a much greyer animal than *L. c. centralis*, with the rufous tones less developed throughout, the difference being especially marked on the nape and throat. On the nape, indeed, the colour is simply grey without any rufous or buffy suffusion at all.

Of other names that have been given to members of this group none seem to apply to the Deelfontein hare. *L. arenarius*, Geoff., has clearly no relationship to it and was said to have come from Natal. *L. ochropus*, Wagn., is the Transvaal species, which was obtained by Capt. Barrett-Hamilton at Bloemhoff, Vredefort Road, and elsewhere, and is readily distinguishable by its much yellower general colour and clear yellow nape.

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XXXI.—On a Collection of Fishes from the Azores.

By C. TATE REGAN, B.A.

THE collection of fishes brought back from the Azores by Mr. W. R. Ogilvie Grant, who obtained them through the kind co-operation of Major F. A. Chaves, of the Ponta Delgada Museum, is of interest as showing the great similarity which exists between the fish-fauna of the shores of these islands and that of Madeira and of the Mediterranean, and also as



containing examples of two species new to science, one of these being the type of a new genus. A complete list is given below.

#### Raiidæ.

*Raia maderensis*, Lowe.

#### Clupeidæ.

*Clupea maderensis*, Lowe.

#### Murænidæ.

*Muræna helena*, Linn.

*Muræna augusti*, Kaup.

*Muræna unicolor*, Delaroche.

*Conger vulgaris*, Cuv.

#### Sternoptychiidæ.

*Argyropelecus Olfersii*, Cuv.

*Sternoptyx diaphana*, Hermann.

#### Scopelidæ.

#### MACRISTIUM, gen. nov.

Allied to *Bathysaurus*, Günth., which it resembles in the position of the fins and the number of rays, but with the mouth only moderately wide, the dentition weaker, the maxillary dilated posteriorly, the fin-rays much prolonged, and the ventrals still more anterior in position.

#### *Macristium Chavesi*, sp. n.

Depth of body  $7\frac{1}{2}$  times in the total length, length of head 5 times. Diameter of eye nearly 8 times in the length of head, interorbital width  $3\frac{1}{3}$  times. Maxillary broad, rounded posteriorly, extending to below the anterior quarter of eye. Dorsal with 18 rays, commencing above the axil of pectoral, the length of its base  $2\frac{1}{3}$  times in the total length (without caudal), the middle and posterior rays, when laid back, extending beyond the base of caudal. No adipose fin. Anal with 12 rays, commencing directly behind the vent, which is slightly posterior to the last dorsal ray. Pectorals with 16 rays, elongate. Ventrals just behind the pectorals, with 8 rays, extending to the caudal. The naked body of a uniform greyish colour.

One specimen. Total length 110 mm. (to base of caudal).

## Syngnathidæ.

*Hippocampus guttulatus*, Cuv.

## Scombresocidæ.

*Belone Cornidii*, Günth.

## Stromateidæ.

*Centrolophus niger*, Gmel.

## Macruridæ.

*Macrurus œlorhynchus*, Risso.

## Gadidæ.

*Uraleptus Maraldi*, Risso.*Phycis mediterræneus*, Delaroche.*Onus Granti*, sp. n.

Depth of body about  $7\frac{1}{2}$  times in the total length, length of head  $4\frac{1}{3}$  times. Snout  $1\frac{2}{3}$ –2 times as long as eye, the diameter of which is 6–7 times in the length of head and greater than the osseous interorbital width. Maxillary extending beyond the posterior margin of eye, and equal to  $\frac{1}{2}$  the length of head. A mental and two nasal barbels. Scales very small. First dorsal ray scarcely longer than the diameter of eye. The second dorsal with 60 rays, the anal with 48. Pectorals rounded, with 21 rays. Ventrals with 7 rays, the second elongate and equal to the length of head. Caudal rounded. Whitish, the upper part of the body with an irregular broad blackish band on each side, posteriorly broken up into spots, separated from a median dorsal band by a white stripe, which is narrow anteriorly, broader posteriorly; upper part of head blackish, except for some narrow white stripes, which are transverse on the snout, longitudinal behind; dorsal with a broad blackish band occupying the basal half of the fin, separated by a longitudinal light stripe from a blackish marginal band; anal with some large dark spots, which are better defined posteriorly; pectorals with dark markings; caudal with 6 or 7 large rounded dark spots.

Two specimens. Total length 390 mm.

## Regalecidæ.

*Trachipterus tenia*, Bl. Schn.

**Berycidaæ.**

*Beryx decadactylus*, Cuv. & Val.

*Hoplostethus mediterraneus*, Cuv. & Val.

**Cyttidæ.**

*Zeus faber*, Linn.

**Serranidæ.**

*Serranus atricauda*, Günth.

**Sparidæ.**

*Box vulgaris*, Cuv. & Val.

*Sargus Rondeletii*, Cuv. & Val.

*Pagellus Owenii*, Günth.

*Pagellus centrodonatus*, Delaroche.

**Mænidæ.**

*Smaris insidiator*, Cuv. & Val.

**Caproidæ.**

*Capros aper*, Lacep.

**Triglidæ.**

*Sebastes dactylopterus*, Delaroche.

*Sebastes Kuhlii*, Bowd.

*Trigla pini*, Bl.

**Labridæ.**

*Labrus mixtus*, Linn.

*Centrolabrus trutta*, Lowe.

*Julis pavo*, Hasselqu.

*Novacula cultrata*, Cuv. & Val.

*Coris julis*, Linn.

*Coris Giofredi*, Risso.

*Scarus cretensis*, Linn.

## Carangidæ.

*Caranx dentex*, Bl. Schn.*Caranx trachurus*, Linn.*Trachynotus glaucus*, Linn.

## Scombridæ.

*Scomber colias*, Linn.

## Trichiuridæ.

*Lepidopus caudatus*, Euphrasen.

## Bramidæ.

*Brama Raii*, Bl.

## Gobiidæ.

*Gobius maderensis*, Cuv. & Val.

## Echeneidæ.

*Echeneis lineata*, Menzies.*Echeneis brachyptera*, Lowe.

## Blenniidæ.

*Blennius sanguinolentus*, Pall.*Blennius gattorugine*, Bl.*Blennius ocellaris*, Linn.

## Tetrodontidæ.

*Tetrodon Spengleri*, Bl.XXXII.—On the Genus *Lichia* of Cuvier.

By C. TATE REGAN, B.A.

THE genus *Lichia* was established by Cuvier in 1817, when, although it was stated that there were several species, only one of these was mentioned by name, viz. *L. amia*, Linn., which must therefore be regarded as the typical species of the genus. In Cuvier and Valenciennes's 'Histoire Naturelle de Poissons' three more species were added, viz. *L. glauca*, Linn., *L. vadigo*, Risso, and *L. calcar*, Bl., whilst a young stage of *L. amia* was described under the name of *Porthmeus*



*argenteus*. Guichenot subsequently described a fifth species as belonging to the genus *Lichia*, naming it *L. albacora*. The relations of this last species are not very evident, but *L. calcar*, Bl., is, without much doubt, based on a young example of *Scombroides saliens*, Bl.

Lüken, recognizing that *L. glauca* should be regarded as generically distinct from *L. amia* and *L. vadiago*, on account of the smaller mouth and the absence of pseudobranchiæ, proposed to retain the name *Lichia* for the former species and to designate the two latter by the generic name *Porthmeus*. This is obviously inadmissible; the name *Lichia* must be given to *L. amia*, whilst *Porthmeus* is a synonym of it. After examining examples of the three species in the British Museum Collection I have arrived at the conclusion that *L. glauca* must be included in the genus *Trachynotus*, Lacep., and that the other species are certainly not congeneric, so that I propose to distinguish *L. vadiago* by the new generic name *Campogramma*.

It has been stated that *L. glauca* may be distinguished from *Trachynotus* by the stronger dentition, more pointed snout, and less produced dorsal and anal fins. The first supposed difference is, so far as I can see, non-existent; as regards the second and third, which are in any case not of generic importance, the form of the snout is exactly the same in *L. glauca* as in *Trachynotus Baillonii*, Lacep., whilst the extent to which the dorsal and anal rays are produced is subject to great variation in the different species, and in *T. Baillonii*, which is in most respects nearest *L. glauca*, they are more produced than in any other.

*L. glauca* should therefore be named *Trachynotus glaucus*, Linn., whilst for *Trachynotus glaucus*, Bl., I propose the name *T. palometa*.

The differences between the genera *Lichia* and *Campogramma* can be seen in the following diagnoses:—

#### LICHIA, Cuv.

Body oblong, compressed, covered with small pointed scales. Mouth wide; premaxillaries protractile; maxillary exposed distally, with supplemental bone; jaws with rather broad bands of numerous small pointed teeth; vomerine and palatine teeth present. Pseudobranchiæ present. Dorsal with an anterior portion composed of a few spines which are free in the adult, and a long posterior soft-rayed portion. Anal preceded by two free spines, equal in length to the soft dorsal. Pectorals rather short, not falcate. Caudal

widely forked. Lateral line ascending above the pectoral, thence descending in a long reversed curve on the lower half of the side, becoming straight posteriorly.

A single species, *L. amia*, Linn.

CAMPOGRAMMA, gen. nov.

Differs from the preceding genus in the rounded scales, the jaws with a single series of rather strong conical teeth, the anal shorter than the soft dorsal, the pectoral of moderate length and falcate, and the lateral line forming a long even curve anteriorly, straight posteriorly.

A single species, *C. vadigo*, Risso.

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XXXIII.—*Descriptions of new Snakes in the Collection of the British Museum.* By G. A. BOULENGER, F.R.S.

*Tretanorhinus tæniatus.*

Head small, narrow; eye small. Nasals in contact with each other behind the rostral; a pair of small internasals, followed by three præfrontals, the median of which is pentagonal and twice as long as broad; frontal once and a half as long as broad, as long as its distance from the rostral, shorter than the parietals; loreal a little longer than deep; two præ- and two postoculars; temporals 1+2 or 2+3; 8 upper labials, fourth entering the eye; 4 or 5 lower labials in contact with the anterior chin-shields; posterior chin-shields longer than the anterior and separated from each other by scales. Scales in 21 rows, striated and keeled. Ventrals 168; anal divided; subcaudals 81. Greyish olive, with a broad, white lateral band occupying the three outer series of scales; this band bordered above by a blackish streak extending to the tip of the snout and passing through the eye; sides of snout and lower surface of head blackish, dotted with white; a dark median streak on the occiput and nape, reappearing on the tail; three ill-defined dark streaks along the belly.

Total length 570 millim.; tail 130.

A single female specimen from the Rio Sapayo, N.W. Ecuador, altitude 450 feet.

*Opisthotropis lateralis.*

Snout short, rounded, much depressed, feebly projecting beyond the mouth. Rostral a little broader than deep, well

visible from above; nostril in the upper part of an undivided nasal; internasals as long as broad; præfrontal semidivided; frontal a little longer than broad, twice as broad as the supra-ocular, as long as its distance from the end of the snout, shorter than the parietals; loreal longer than deep; two præ- and two postoculars; temporals 1+2; ten upper labials, fifth and sixth entering the eye; four or five lower labials in contact with the anterior chin-shields; posterior chin-shields nearly as long as the anterior and separated from each other by scales. Scales in 17 rows, striated and feebly keeled, with minute granular asperities; the keels stronger on the tail. Ventrals 172; anal divided; subcaudals 45. Olive-grey above, yellowish white beneath, the two colours sharply defined by a black line running along the third series of scales and extending to the eye.

Total length 360 millim.; tail 55.

A single male specimen from the Man-Son Mountains, Tonkin, altitude 3000 to 4000 feet, collected by Hr. Fruhstorfer.

*Liophis bipræocularis.*

Eye rather small. Rostral much broader than deep, just visible from above; internasals broader than long, much shorter than the præfrontals; frontal once and two thirds as long as broad, slightly longer than its distance from the end of the snout, a little shorter than the parietals; no loreal, posterior nasal in contact with the præoculars; two præ- and two postoculars; temporals 1+2; seven upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are a little shorter than the posterior. Scales in 17 rows. Ventrals 173; anal divided; subcaudals 62. Olive-brown above, with ill-defined blackish spots anteriorly; posterior half of body with two black dorsal lines, separated by three series of scales, and a black lateral band; the two dorsal lines unite on the tail, which bears three black bands of equal width; a subtriangular black blotch on each side of the nape, as usual in *Tropidonotus natrix*; upper lip white; lower parts pinkish, the ventrals with small blackish spots.

Total length 530 millim.; tail 110.

A single female specimen from Facatative, Andes of Colombia, 8000 feet, collected by Mr. Kay Thomson.

*Simotes longicauda.*

Nasal divided; portion of rostral visible from above as long as its distance from the frontal; suture between the

internasals slightly shorter than that between the præfrontals; frontal longer than its distance from the end of the snout, as long as the parietals; loreal slightly longer than deep; one præ- and two postoculars; no suboculars; temporals 1+2; 7 or 8 upper labials, fourth and fifth, or third (divided) and fourth entering the eye; anterior chin-shields longer than the posterior and in contact with four lower labials. Scales in 17 rows. Ventrals 173; anal entire; subcaudals 60. Pale purplish brown above, with interrupted or ill-defined black cross-bars and 15 regular cross-bars enclosing a dark brown spot on the back; an angular dark brown black-edged cross-band passing through the eyes, forming a triangle on the snout, extending from the posterior angle of the rostral shield to the anterior fourth of the frontal; a large,  $\Lambda$ -shaped, dark brown, black-edged marking from the frontal shield to the nape; belly yellowish, with square black spots.

Total length 530 millim.; tail 105.

A single male specimen from the Man-Son Mountains, Tonkin, 3000 to 4000 feet, collected by Hr. Fruhstorfer.

Very closely allied to *S. cyclurus*, Cantor, but apparently outside the possible limits of variation of that species.

#### *PÆCILOPHOLIS*, gen. nov.

*Colubridæ aglyphodontæ*. Teeth small, subequal, about ten in each maxillary. Head small, not distinct from neck; eye small, with round pupil; nostril pierced in a single nasal; no supranasals; præfrontal single, in contact with the rostral; no loreal; præocular in contact with the nasal. Body cylindrical; scales smooth, without apical pits, in 15 rows; ventrals rounded. Tail short; subcaudals in two rows.

#### *Pæcilopholis cameronensis*.

Snout rounded. Rostral bent over the snout between the rather large nasals, forming a suture with the præfrontal, which is twice as broad as long; frontal a little longer than broad, a little longer than the præfrontal, two thirds the length of the parietals; one præ- and two postoculars; an elongate anterior temporal; five upper labials, third bordering the eye; chin-shields small, the anterior a little shorter than the posterior and in contact with three lower labials. Scales in 15 rows. Ventrals 178; anal divided; subcaudals 23. Blackish olive above, the lateral scales whitish in the centre; upper lip and a triangular patch from



behind the labials to the outer border of the parietal white; lower parts white, the shields edged with dark olive.

Total length 520 millim.; tail 43.

A single specimen from Efulen, S. Cameroon, collected by Mr. G. L. Bates.

*Homalocranium alticola.*

Eye about two fifths the length of the snout. Rostral a little broader than deep, visible from above; internasals a little shorter than the præfrontals; frontal hexagonal, obtuse-angled in front, right-angled or acute-angled behind, twice as broad as the supraocular, a little longer than broad, longer than its distance from the end of the snout, shorter than the parietals; nostril between two nasals, the second of which is in contact with the præocular; two postoculars; temporals 1+1; seven upper labials, third and fourth entering the eye; symphysial in contact with the anterior chin-shields; four lower labials in contact with the anterior chin-shields, which are longer than the posterior. Scales in 15 rows. Ventrals 147-149; anal divided; subcaudals 55-64. Dark brown above, vertebral and lateral scales lighter in the centre; a yellow, black-edged cross-bar on the occiput; upper lip and end of snout yellow; a black spot below the eye and a triangular black blotch on the temple; lower parts yellowish white.

Total length 330 millim.; tail 75.

Three specimens (males and young) from Santa Rita, north of Medellin, Colombia, altitude 9000 feet, collected by Mr. A. E. Pratt.

*Apostolepis Pymi.*

Snout very short, broadly rounded; eye minute. Rostral nearly as deep as broad, just visible from above; frontal once and two thirds as long as broad, as long as its distance from the end of the snout, half as long as the parietals, which are nearly twice as long as broad; nasal in contact with the præocular; a single postocular; six upper labials, second and third entering the eye, fourth and fifth in contact with the parietal; four lower labials in contact with the anterior chin-shields, which are a little longer than the posterior; first lower labial in contact with its fellow behind the symphysial. Scales in 15 rows. Ventrals 209; anal divided; subcaudals 35. Reddish above, with three dark brown lines; upper surface of head and nape brown; a yellow spot below

and behind the eye and another on each side of the nape; lower parts yellowish white; end of tail black.

Total length 385 millim.; tail 48.

A single male specimen from Brazil, from the collection of the late Mr. J. Pym.



*Miodon Christyi.*

Diameter of eye three fifths its distance from the oral margin. Rostral broader than deep, just visible from above; internasals a little shorter than the præfrontals; frontal considerably broader than the supraocular, a little longer than broad, as long as its distance from the rostral, much shorter than the parietals; nasal entire, in contact with the præocular; two postoculars; temporals 1+1; seven upper labials, third and fourth entering the eye; first lower labial forming a suture with its fellow behind the symphysial; four lower labials in contact with the anterior chin-shields, which are larger than the posterior. Scales in 15 rows. Ventrals 209; anal divided; subcaudals 20. Black above and on the lower surface of the head; ventrals and subcaudals white, broadly margined with black.

Total length 430 millim.; tail 28.

A single female specimen from Uganda. Presented by Dr. C. Christy.

*Lachesis peruvianus.*

Snout obtusely acuminate, with sharp, somewhat raised canthus. Rostral a little deeper than broad; nasal divided; upper head-scales keeled; a large supraocular; 7 longitudinal series of scales between the supraoculars; a narrow subocular shield between the eye and the fourth labial; temporal scales strongly keeled; 7 or 8 upper labials, second forming the anterior border of the loreal pit. Scales strongly keeled, in 23 rows. Ventrals 188; anal entire; subcaudals 66, all except a few of the anterior in pairs. Tail prehensile. Green, anteriorly with black and yellowish spots, further back with angular yellowish-white cross-bands which are edged with black alternately in front or behind; a series of large yellowish spots on each side, above the ventrals; a -shaped blackish marking on the head, and two others, -shaped, on the occiput; a broad black band on each side from the eye to the angle of the mouth; belly yellowish, spotted with pale green; a yellowish, black-edged streak along each side of the tail.

Total length 555 millim.; tail 80.

A single female specimen from La Oroya, Carabaya, S.E. Peru, collected by Mr. Ockenden.

XXXIV.—*List of the African Species of the Cyprinid Genus Labeo, with a Key to their Identification.* By G. A. BOULENGER, F.R.S.

ONLY 8 species of *Labeo* from Africa, including 2 referred to *Abrostomus*, were regarded as valid in the seventh volume of the British Museum Catalogue of Fishes, published in 1868. 30 species, 15 of which have been described within the last five years, appear in the following list.

As always happens when a large number of specimens are available for examination, the range of variation of species is found to extend considerably beyond the limits assigned by the original describers, and, in consequence, the distinction of allied forms becomes a more and more difficult task. On the other hand, the employment of characters previously neglected or altogether overlooked affords a basis for a complete rearrangement, and may necessitate the breaking up of some of the old species. The result of such a rearrangement is offered in the following synopsis, which is greatly needed owing to the state of confusion into which the distinction of species in this genus had gradually lapsed.

Some of the characters used in the following key are not applicable to very young specimens—one to two inches in length; such are, the position and size of the eyes and the shape of the dorsal fin, as all very young specimens agree in having the eyes comparatively large and perfectly lateral and the dorsal fin straight-edged or very feebly concave. The condition of the lips is also difficult of appreciation in very young specimens, owing to the small size. The numbers of fin-rays and of scales are always reliable, whatever the age of the specimen. All African *Labeo* have five branched rays in the anal fin. The scale-formulæ as given in the key refer first to the number of scales in the lateral line, secondly to the numbers in a transverse series above and below the lateral line, in front of the origin of the dorsal fin, thirdly to the number of series between the lateral line and the base of the ventral, and lastly to the number round the caudal peduncle.

I. Barbels absent, or one on each side, often very small and hidden under the folds of the mouth.

A. Inner surface of lips not bearing transverse plicæ; eyes perfectly lateral, visible from above and from below; snout hardly as long as, or shorter than, postocular part of head; a small barbel; dorsal fin nearer occiput than root of caudal.

1. Upper lip bordered with rounded or subconical papillæ.

Dorsal with 14–17 branched rays; Sq. 41–45

$8\frac{1}{2}$ – $9\frac{1}{2}$   
 $6\frac{1}{2}$ – $10\frac{1}{2}$  5–6, 18–22; upper edge of dorsal fin

usually concave, rarely straight or slightly

convex ..... 1. *L. niloticus*, Forsk.

2. Upper lip bordered with conical papillæ forming a very distinct fringe.

a. Upper edge of dorsal fin straight or more or less convex.

Dorsal with 12-14 branched rays; Sq. 40-44

$\frac{7-7\frac{1}{2}}{6\frac{1}{2}-8\frac{1}{2}}$ , 4-5, 16-20 ..... 2. *L. horie*, Heck.

Dorsal with 12-14 branched rays; Sq. 37-40

$\frac{6-6\frac{1}{2}}{6\frac{1}{2}}$ , 4, 16 ..... 3. *L. senegalensis*, C. & V.

Dorsal with 12-13 branched rays; Sq. 36  $\frac{6\frac{1}{2}}{6\frac{1}{2}}$ ,

$4\frac{1}{2}$  ..... 4. *L. Steindachneri*, Pfeff.

Dorsal with 11 branched rays; Sq. 36-38

$\frac{5\frac{1}{2}-6\frac{1}{2}}{6\frac{1}{2}-7\frac{1}{2}}$ ,  $4\frac{1}{2}$ , 16-18 ..... 5. *L. altivelis*, Ptrs.

b. Upper edge of dorsal fin more or less concave.

Dorsal with 12 branched rays; Sq. 36  $\frac{6\frac{1}{2}}{7\frac{1}{2}}$ ,

5, 18 ..... 6. *L. Rosæ*, Sldr.

Dorsal with 10-12 branched rays; Sq. 38-40

$\frac{6\frac{1}{2}}{6\frac{1}{2}}$ , 4-5, 16-18 ..... 7. *L. mesops*, Gthr.

Dorsal with 10-12 branched rays; Sq. 36-37

$\frac{6\frac{1}{2}}{5\frac{1}{2}-6\frac{1}{2}}$ , 3, 16 ..... 8. *L. lineatus*, Blgr.

B. Inner surface of lips bearing transverse plicæ formed by series of papillæ.

1. Eyes perfectly lateral, visible from above and from below, or nearly perfectly lateral.

a. Dorsal fin high, with straight or convex (rarely slightly concave) upper edge, not nearer eye than root of caudal, with 12-14 branched rays; Sq. 36-40  $\frac{6\frac{1}{2}-7\frac{1}{2}}{6\frac{1}{2}-8\frac{1}{2}}$ , 4-5, 16-18.

No barbel; caudal peduncle nearly twice as deep as long .....

9. *L. velifer*, Blgr.

A small barbel; caudal peduncle much deeper than long; pectoral reaching ventral .....

10. *L. longipinnis*, Blgr.

A small barbel; caudal peduncle not, or but slightly, deeper than long; pectoral not reaching ventral .....

11. *L. coubie*, Rüpp.

b. Dorsal fin nearer eye than root of caudal; Sq. 35-39  $\frac{5\frac{1}{2}-6\frac{1}{2}}{6\frac{1}{2}-8\frac{1}{2}}$ , 4-5, 16.

Dorsal high, convex, with 11 branched rays; diameter of eye at least 3 times in interorbital width .....

12. *L. congoro*, Peters.

Dorsal with concave upper edge, with 10 or 11 branched rays; diameter of eye not twice in interorbital width .....

13. *L. Gregorii*, Gthr.

Dorsal with concave upper edge, with 10 branched rays; diameter of eye  $2\frac{1}{4}$  in interorbital width .....

14. *L. Darlingi*, Blgr.

Dorsal with concave upper edge, with 9 or 10 branched rays; diameter of eye at least 3 times in interorbital width .....

15. *L. victorianus*, Blgr.



2. Eyes supero-lateral, entirely or nearly entirely visible from above.

a. Dorsal with 11-12 branched rays, equally distant from eye and from caudal; depth of body about 3 times in total length; caudal peduncle as long as deep;

Sq. 35-38  $\frac{6\frac{1}{2}}{7\frac{1}{2}}$ , 4, 16 ..... 16. *L. cyclorhynchus*, Blgr.

b. Dorsal with 8-11 branched rays, nearer eye than caudal; depth of body usually more than 3 times in total length.

a. 20-22 scales round caudal peduncle.

Caudal peduncle deeper than long; Sq. 39

$\frac{7\frac{1}{2}-8\frac{1}{2}}{9\frac{1}{2}-10\frac{1}{2}}$ , 5, 20 ..... 17. *L. falcipinnis*, Blgr.

Caudal peduncle a little longer than deep;

Sq. 39  $\frac{6\frac{1}{2}}{7\frac{1}{2}}$ , 4, 22 ..... 18. *L. Kirkii*, Blgr.

β. 16-18 scales round caudal peduncle.

\* Caudal peduncle longer than deep; dorsal with concave upper edge.

Dorsal with 10 (rarely 9 or 11) branched rays; eye small, its diameter  $5\frac{1}{2}$  to 8 times in length of head; Sq. 38-42  $\frac{6\frac{1}{2}-7\frac{1}{2}}{7\frac{1}{2}-8\frac{1}{2}}$ , 4-5,

16-18 ..... 19. *L. Forskalii*, Rüpp.

Dorsal with 8 to 10 branched rays; diameter of eye 4 to 7 times in length of head;

Sq. 35-39  $\frac{5\frac{1}{2}-6\frac{1}{2}}{6\frac{1}{2}-7\frac{1}{2}}$ , 3-4, 16 ..... 20. *L. cylindricus*, Peters.

\*\* Caudal peduncle as long as deep or a little deeper than long; dorsal with 10 branched rays.

Dorsal with straight or slightly notched upper edge in the adult; diameter of eye 4 to 6 times in length of head; Sq. 38-39  $\frac{7\frac{1}{2}}{7\frac{1}{2}-8\frac{1}{2}}$ ,

4, 16-18 ..... 21. *L. macrostoma*, Blgr.

Dorsal with concave upper edge; diameter of eye 7 times in length of head in adult; snout pointed, ending in a turned up appendage; Sq. 38-39  $\frac{6\frac{1}{2}}{7\frac{1}{2}}$ , 4, 16. .... 22. *L. nasus*, Blgr.

Dorsal with concave upper edge; diameter of eye 4 to  $5\frac{1}{2}$  times in length of head;

Sq. 37-38  $\frac{6\frac{1}{2}}{7\frac{1}{2}}$ , 4, 16 ..... 23. *L. Greenii*, Blgr.

γ. 12 scales round caudal peduncle; dorsal with 9 or 10 branched rays.

\* Dorsal with straight or convex upper edge; caudal peduncle not longer than deep;

Sq. 32-34  $\frac{4\frac{1}{2}}{6\frac{1}{2}}$ , 3, 12 ..... 24. *L. brachypoma*, Gthr.

\*\* Dorsal with concave upper edge.

Caudal peduncle longer than deep; Sq. 36-39

$\frac{4\frac{1}{2}}{7\frac{1}{2}}$ , 3, 12 ..... 25. *L. annectens*, Blgr.

Caudal peduncle longer than deep; Sq. 35

$\frac{5\frac{1}{2}}{7\frac{1}{2}}$ , 4, 12 ..... 26. *L. Lukulae*, Blgr.

Caudal peduncle not or but slightly longer

than deep; Sq. 33-35  $\frac{4\frac{1}{2}}{5\frac{1}{2}-6\frac{1}{2}}$ , 3, 12 ..... 27. *L. parvus*, Blgr.

II. Two barbels on each side.

Dorsal with 10 or 11 soft rays; eyes supero-lateral; barbels longer than the eye;

Sq. 40-41  $\frac{8\frac{1}{2}}{9\frac{1}{2}-10\frac{1}{2}}$ , 6, 20-22 ..... 28. *L. barbatus*, Blgr.

Dorsal with 10 or 11 soft rays; eyes perfectly lateral; barbels hardly as long as,

or shorter than, the eye; Sq. 46-50  $\frac{8\frac{1}{2}-9\frac{1}{2}}{10\frac{1}{2}-11\frac{1}{2}}$ , 6-7, 22-24 ..... 29. *L. capensis*, Smith.

Dorsal with 8 to 10 soft rays; eyes perfectly lateral; barbels hardly as long as, or

shorter than, the eye; Sq. 60-65  $\frac{13\frac{1}{2}-14\frac{1}{2}}{15\frac{1}{2}-16\frac{1}{2}}$ , 9-10, 32-34 ..... 30. *L. umbratus*, Smith.

### 1. *Labeo niloticus*.

*Cyprinus niloticus*, Forskål, Descr. Anim. p. 71 (1775); Geoffr. Descr. Egypte, Poiss. pl. ix. fig. 2 (1809).

*Labeo niloticus*, I. Geoffr. *op. cit.* p. 282 (1827).

*Labeo niloticus*, part., Cuv. & Val. Hist. Poiss. xvi. p. 338 (1842); Günth. Cat. Fish. vii. p. 47 (1868), and Petherick's Trav. Afr. ii. p. 259 (1869).

*Labeo vulgaris*, Heckel, Russegger's Reise, iii. p. 303, pl. xx. fig. 3 (1846).

Nile.

### 2. *Labeo horie*.

Heckel, Russegger's Reise, iii. p. 304, pl. xxi. fig. 1 (1846).

*Chondrostoma dembeensis* (non Rüpp.), Cuv. & Val. Hist. Poiss. xvii. p. 398 (1844).

*Labeo niloticus*, part., Günth. Cat. Fish. vii. p. 47 (1868), and Petherick's Trav. ii. p. 259 (1869).

Nile and Albert Nyanza.

### 3. *Labeo senegalensis*.

Cuv. & Val. Hist. Poiss. xvi. p. 346, pl. cccclxxxvi. (1842); Steind. Sitzb. Ak. Wien, lxi. 1870, p. 560, pl. vi. & pl. viii. fig. 1.

Senegal, Gambia, Niger.

### 4. *Labeo Steindachneri*.

Pfeffer, Fische O.-Afr. p. 51 (1896).

Kingani R., East Africa.

5. *Labeo altivelis*.

Peters, Mon. Berl. Ac. 1852, p. 683, and Reise Mossamb. iv. p. 43, pl. viii. (1868).

*Labeo coubie*, part., Günth. Cat. Fish. vii. p. 48 (1868).

Zambesi, Nyassa.

6. *Labeo Rosæ*.

Steind. Sitz. Ak. Wien, ciii. 1894, p. 457, pl. v. fig. 1.

Limpopo R., S. Africa.

7. *Labeo mesops*.

Günth. Cat. Fish. vii. p. 51 (1868).

*Labeo coubie*, part., Günth. t. c. p. 48.

Nyassa.

8. *Labeo lineatus*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 34, pl. xviii. (1898), and Poiss. Bass. Congo, p. 213 (1901).

Congo.

9. *Labeo velifer*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 32, pl. xvi. (1898), and Poiss. Bass. Congo, p. 211 (1901).

Congo.

10. *Labeo longipinnis*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 33, pl. xvii. fig. 1 (1898), and Poiss. Bass. Congo, p. 212 (1901).

Congo.

11. *Labeo coubie*.

Rüpp. Fortsetz. Beschr. n. Fische Nil, p. 11, pl. iii. fig. 1 (1832); Cuv. & Val. Hist. Poiss. xvi. p. 344 (1842).

*Labeo niloticus*, part., Cuv. & Val. t. c. p. 338.

*Labeo seltsi*, Cuv. & Val. t. c. p. 345; Steind. Sitzb. Ak. Wien, lxi. 1870, p. 562, pl. vii. fig. 1.

*Labeo niloticus*, Heckel, Russegger's Reise, iii. p. 300, pl. xx. fig. 1 (1846); Peters, Reise Mossamb. iv. p. 46 (1868).

*Labeo coubie*, part., Günth. Cat. Fish. vii. p. 48 (1868), and Petherick's Trav. ii. p. 260 (1869).

Nile, Senegal, Gambia, Niger.

12. *Labeo congoro*.

Peters, Mon. Berl. Ac. 1852, p. 683, and Reise Mossamb. iv. p. 45, pl. ix. (1868).

*Labeo coubie*, part., Günth. Cat. Fish. vii. p. 48 (1868).

Zambesi.

13. *Labeo Gregorii*.

Günth. Proc. Zool. Soc. 1894, p. 90, pl. x. fig. B.

*Labeo Bottegi*, Vincig. Ann. Mus. Genova, (2) xvii. 1897, p. 358.

East Africa (Ganana R., Tana R., Rovuma R.).

14. *Labeo Darlingi*.

Bouleng. Proc. Zool. Soc. 1902, ii. p. 13, pl. ii. fig. 1.

Rhodesia.

15. *Labeo victorianus*.

Bouleng. Proc. Zool. Soc. 1901, p. 159.

*Labeo Forskalii* (non Rüpp.), Hilgendorf, Sitzb. Ges. naturf. Fr. Berl. 1888, p. 78.

Victoria Nyanza.

16. *Labeo cyclorhynchus*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 98, pl. xi. fig. 1 (1899), and Poiss. Bass. Congo, p. 214 (1901).

Var. *variegata*, Pellegrin, Bull. Mus. Paris, 1901, p. 332.

Congo.

17. *Labeo falcipinnis*, n. n.

*Labeo falcifer* (non C. & V.), Bouleng. Ann. Mus. Congo, Zool. i. p. 35, pl. xvii. fig. 2 (1898), and Poiss. Bass. Congo, p. 215 (1901).

Congo.

The name *falcifer*, which I proposed for this species, was already in use for a species referred to *Tylognathus*.

18. *Labeo Kirkii*, sp. n.

*Labeo Forskalii*, part., Günth. Cat. Fish. vii. p. 50 (1868).

This new species is founded on a single specimen from the Rovuma River, East Africa, collected by Sir J. Kirk, and referred by Günther to *L. Forskalii*, from which it differs in the greater number of scales round the caudal peduncle.

19. *Labeo Forskalii*.

Rüpp. Mus. Senck. ii. p. 18, pl. iii. fig. 1 (1835); Cuv. & Val. Hist. Poiss. xvi. p. 343 (1842); Heckel, Russegger's Reise, iii. p. 301, pl. xx. fig. 2 (1846); Günth. Cat. Fish. vii. p. 50 (part.), and Petherick's Trav. ii. p. 260 (1869).

Nile.



20. *Labeo cylindricus*.

Peters, Mon. Berl. Ac. 1852, p. 684, and Reise n. Mossamb. iv. p. 47, pl. x. fig. 1 (1868).

*Tylognathus Cantini*, Sauvage, Bull. Soc. Philom. (7) vi. 1882, p. 175; Vincig. Ann. Mus. Genova, (2) xv. 1895, p. 50, and xix. 1898, p. 259.

*Tylognathus montanus*, Günth. Proc. Zool. Soc. 1889, p. 71, pl. viii. fig. B.

*Labeo Forskalii*, part., Pfeffer, Fische O.-Afr. p. 49, fig. (1896).

*Labeo montanus*, Pfeffer, t. c. p. 52.

? *Labeo mesops* (non Günther), Vincig. Ann. Mus. Genova, (2) xvii. 1897, p. 361.

Abyssinia and East Africa to Mozambique.

21. *Labeo macrostoma*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 36, pl. xix. fig. 1 (1898), and Poiss. Bass. Congo, p. 216 (1901).

Congo.

22. *Labeo nasus*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 99, pl. lx. fig. 2 (1899), and Poiss. Bass. Congo, p. 218 (1901).

Congo.

23. *Labeo Greenii*.

Bouleng. Ann. Mus. Congo, Zool. ii. p. 29, pl. viii. fig. 4 (1902).

Congo.

24. *Labeo brachypoma*.

Günth. Cat. Fish. vii. p. 50 (1868).

*Labeo Walkeri*, Günther, Proc. Zool. Soc. 1902, ii. p. 338, pl. xxxiii.

Lagos and Gold Coast.

25. *Labeo annectens*.

Bouleng. Proc. Zool. Soc. 1903, i. p. 23, pl. ii. fig. 1.

S. Cameroon.

26. *Labeo Lukulae*.

Bouleng. Proc. Zool. Soc. 1902, i. p. 235, pl. xxiii.

Lukula R., Congo.

27. *Labeo parvus*.

Bouleng. Ann. Mus. Congo, Zool. ii. p. 30, pl. viii. fig. 5 (1902).

Congo.

28. *Labeo barbatus*.

Bouleng. Ann. Mus. Congo, Zool. i. p. 33, pl. xix. fig. 2 (1898), and Poiss. Bass. Congo, p. 218 (1901).

Congo.

29. *Labeo capensis*.

*Abrostomus capensis*, A. Smith, Ill. Zool. S. Afr., Fish. pl. xii. fig. 2 (1841).

? *Labeo cafer*, Castelnau, Mém. Poiss. Afr. Austr. p. 60 (1861).

*Labeo tenuirostris*, Steind. Sitzb. Ak. Wien, ciii. 1894, p. 459, pl. v. fig. 2.

Orange R., Limpopo R.

30. *Labeo umbratus*.

*Abrostomus umbratus*, A. Smith, Ill. Zool. S. Afr., Fish. pl. xii. fig. 1 (1841).

*Labeo Sichelii*, Castelnau, Mém. Poiss. Afr. Austr. p. 60 (1861).

Orange R. System.

Of these 30 species, according to our present knowledge of their distribution, 11 are peculiar to the Congo System, 7 to East Africa east of the Nile System, southwards to the Zambesi (including Lake Nyassa), 4 to the Nile System, 4 to South Africa (Limpopo and Orange Rivers), 2 to West Africa from the Niger northwards, 1 to the Cameroon District; and one species is common to the Nile System and to the Senegal-Niger.

XXXV.—*Description of a new Silurid Fish of the Genus Clarias from British Central Africa.* By G. A. BOULENGER, F.R.S.

*Clarias Carsonii*.

Depth of body 7 times in total length, length of head  $4\frac{1}{4}$ . Head  $1\frac{1}{2}$  as long as broad, smooth; occipital process angular; frontal fontanelle sole-shaped,  $2\frac{1}{2}$  as long as broad, 4 times in length of head; occipital fontanelle small, encroaching a little on occipital process; eye very small, 4 times in length of snout, 7 times in interorbital width; width of mouth a little less than interorbital width,  $\frac{2}{5}$  length of head; vomerine teeth conical, forming a crescentic band which is about as broad as the præmaxillary band; nasal barbel  $\frac{1}{2}$  length of head; maxillary barbel  $\frac{2}{3}$  length of head, not reaching gill-

opening; outer mandibular barbel  $1\frac{1}{2}$  length of inner, which measures  $\frac{1}{2}$  length of head. Gill-rakers short and wide apart, 10 on first arch. Clavicles concealed under the skin. Dorsal about 65, its distance from the occipital process  $\frac{2}{3}$  length of head, its distance from caudal fin equal to diameter of the eye. Anal 60, nearly touching caudal. Pectoral not quite  $\frac{1}{2}$  length of head, the spine not serrated, about  $\frac{2}{3}$  the length of the fin. Ventrals much nearer end of snout than caudal. Caudal  $\frac{1}{2}$  length of head. Uniform dark brown.

Total length 1500 millim.

Fwambo, British Central Africa.

A single specimen, presented to the British Museum by Mr. A. Carson in 1894.

XXXVI.—*On some new Genera and Species of Parasitic Hymenoptera from the Khasia Hills, Assam.* By P. CAMERON.

[Continued from p. 273.]

*Aglaojoppa rufofemorata*, sp. n.

This species has the general coloration, including the red femora, of *A. Rothneyi*, but may readily be separated from it as follows:—

Scutellum not distinctly dilated at the base; the top of the posterior median area not separated from the areola by a distinct curved keel, areola almost smooth; the marks on the abdomen widely separated .....	<i>rufofemorata</i> .
Scutellum distinctly dilated at the base, the top of the posterior median area distinctly separated from the areola by a rounded keel, the areola irregularly rugose; the marks on the second and third abdominal segments not widely separated.....	<i>Rothneyi</i> , Cam.

Black; the face, clypeus, inner orbits, the lower two thirds of the outer entirely, the base of the mandibles, palpi, the top of the prothorax broadly, a line on the lower edge, two long lines on the mesonotum, the scutellar keels, scutellums, the sides and apex of the postpetiole, and large, irregular, widely separated marks on the second to the fifth abdominal segments, a large irregular mark on the lower side of the mesopleuræ, narrowed at the apex and with a triangular incision on the lower side at the base, and with its

lower basal part extending on to the mesosternum, a line under the hind wings, a large oblique mark on the metapleuræ, and the outer area of the metanotum, pale yellow. Antennæ black, the scape beneath and a broad band on the middle of the flagellum white; the apex of the flagellum brownish. The four front legs are pallid yellow, their femora and tibiæ lined behind with black; the hinder coxæ black, yellow above, their trochanters yellow; the femora red to near the apex; the tibiæ pale yellow to shortly beyond the middle, the rest black; the tibiæ pale yellow. Wings hyaline, the nervures and stigma black. ♀.

Length 19 mm.

*Hab.* Khasia. Coll. Rothney.

Head sparsely punctured, the part below the outer ocelli rugose. Thorax closely punctured, the median segment more closely and strongly than the rest; the areola irregularly wrinkled in the centre, the sides furrowed, the upper half of the posterior median area strongly irregularly reticulated and with a fovea in the centre on the top; the lower part is more closely and not so strongly reticulated. Centre of postpetiole closely longitudinally striated; the second, third, and fourth segments are closely punctured, the base closely, longitudinally, and finely striated. The gastrocœli shallow.

*Aglaojoppa violaceipennis*, sp. n.

Black; the inner orbits narrowly in the middle, broadly above and below, the lower half of the outer entirely, the face, clypeus, labrum, a triangular mark on the base of the mandibles, palpi, the edge of the pronotum, two short broad marks on the middle of the mesonotum, the scutellums, two large marks on the apex of the median segment on the sides, a mark on the lower side of the propleuræ, the tubercles, the lower half of the mesopleuræ, a mark under the hind wings, a large mark in the middle of the metapleuræ, and an irregular mark on the sides of the basal two segments of the abdomen, orange-yellow. Legs lemon-yellow; the hinder coxæ (except at the base above and at the apex below), the fore femora behind (except at the apex below), the middle behind (except in the centre above), the hinder trochanters, the base and apex of the hinder femora, and the apices of their tibiæ, black. Wings uniformly fuscous violaceous, the hinder paler than the anterior. ♀.

Length 18 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus rough, sparsely pilose; a mark above



the clypeus, the foveæ, and the edge below, black. Upper inner orbits acutely margined. Mesonotum distinctly but not closely punctured. Scutellum almost impunctate, its apex black, more broadly in the centre than laterally. Areola distinctly wider than long, short, broadly rounded at the base, the apex raised, almost transverse, the inner part depressed, irregularly rugose; the posterior median area closely transversely rugose, more coarsely and irregularly at the sides; the spiracular stoutly obliquely striated. Petiole broadly depressed, the sides acutely raised; the depression transversely striated; postpetiole stoutly, sharply, longitudinally striated in the middle; the second to the fifth segments closely punctured, the second stoutly longitudinally striated. Gastrocelli deep, smooth, except for a few striæ at the base.

*Aglaojoppa quadrimaculata*, sp. n.

Black; the face, clypeus, the inner orbits (forming two triangular united marks), a large mark (triangularly narrowed above, round below) on the lower half of the outer orbits, a triangular yellow mark on the base of the mandibles, the palpi, a broad line on the pronotum, two short broad lines in the middle of the mesonotum, the scutellums, the apex of the posterior lateral areæ of the median segment, a mark (narrowed behind) on the hinder part of the propleuræ, the lower half of the mesopleuræ, a mark below the hind wings, a small irregular one behind the spiracles, an oval irregular one in the middle of the metapleuræ, and two marks on the apex of the basal two abdominal segments, orange-yellow. ♀.

Length 17 mm.

*Hab.* Khasia. Coll. Rothney.

Face closely and strongly punctured, the clypeus more sparsely punctured; the ocellar region rugose. Scape of antennæ bright yellow below; the flagellum fuscous, with a broad white band near the middle. Mesonotum sparsely punctured, the punctures smaller on the sides. Areola broader than long, narrowed and rounded behind, the apex with a slight rounded incision; it is smooth; the posterior median area is closely transversely striated; on the sides of the lower half is a stout longitudinal keel, united to the sides above and forming an enclosed area, inside of which are a few stout curved keels; the other areæ are obliquely irregularly striated. Propleuræ sparsely punctured, striated behind, the mesopleuræ more closely and strongly punctured, except in the centre behind; the metapleuræ are still more closely and strongly punctured. Legs lemon-yellow; the hinder

coxæ (except for an oblique mark on the outer side above), the hinder trochanters, the base narrowly, the apex more broadly of the hinder femora, and the apex of the hinder tibiæ, black. Wings fuscous violaceous, the stigma and nervures fuscous. Petiole hollowed in the centre and keeled laterally; the postpetiole raised in the middle and stoutly, irregularly, longitudinally striated, its sides punctured; the second to fifth segments closely punctured. Gastrocœli large, deep, the basal half stoutly striated.

Agrees closely in coloration with *A. violaceipennis*; may be known from it by the areola not being hollowed, by the paler more fuscous wings, and by the fuscous stigma and nervures.

*Aglaojoppa 5-maculata*, sp. n.

Black; a triangular yellow mark at the base of the mandibles, the edge of the pronotum broadly, two lines on the mesonotum with a curved projection on the outer side near the base, the scutellums, two large marks on the median segment (half on the metanotum, half on the pleuræ), two lines on the lower part of the propleuræ, the lower half of the mesopleuræ, a mark under the hind wings, the postpetiole, and two large marks on the apex of the second and third segments, lemon-yellow. Legs lemon-yellow, the four anterior femora behind, the posterior entirely, the hinder coxæ (except at the base above), and the apex of the hinder tibiæ, black. Wings almost hyaline, the apex with a fuscous-violaceous tinge; the stigma and nervures black. Flagellum white in the middle, the scape yellow below. ♀.

Length 18 mm.

*Hab.* Khasia. Coll. Rothney.

Head lemon-yellow, the middle of the front broadly, the ocellar region, and the occiput, black. Face and clypeus sparsely punctured and covered with short white hair; there is a small black mark in the centre of the clypeus at the apex. Mesonotum closely punctured in the centre. Scutellum with scattered punctures. Base of the median segment aciculated, the outer side with scattered punctures; the apex, and more particularly the posterior median area, strongly punctured. Pleuræ closely punctured, the metapleuræ more strongly than the rest. The middle of the postpetiole longitudinally striated; the middle of the second segment entirely and the basal half of the third longitudinally striated.

*Aglaojoppa latemaculata*, sp. n.

Black, the mandibles broadly at the base, the upper edge

of the pronotum broadly, the mark dilated at the apex, the lower half of the prosternum behind, two longish lines on the centre of the mesonotum, the scutellums, two large oblique marks on the apex of the median segment, extending on to the pleuræ, the lower half of the mesopleuræ, the mesosternum, except for a triangular black mark in the middle at the base, the apices of the basal two abdominal segments broadly, two large lateral marks occupying the apical two thirds of the second and two similar, but smaller, ones on the apex of the third segment, yellow. Legs yellow, a line on the four front femora behind, the hinder coxæ, the femora, the apex of their tibiæ, the base narrowly and the apices of the four front tibiæ, black. Wings hyaline, the apical half fuscous violaceous, the stigma and nervures black. ♂.

Length 13 mm.

*Hab.* Khasia. Coll. Rothney.

Head lemon-yellow, the front and vertex in the middle, the greater part of the occiput and the outer orbits broadly above, black. Face and clypeus almost bare, sparsely punctured. Mesosternum sparsely punctured. The keels bounding the areola are thin and indistinct; the latter is smooth and shining and has an oblique slope at the base. Posterior median area rounded above, closely punctured, the punctures round and shallow; the spiracular and other areæ closely punctured.

*Xanthojoppa geniculata*, sp. n.

Yellow, the ocellar region, a line in front of it, a broader line behind, the greater part of the occiput, the apex of the mandibles, the base of the mesonotum in the centre, its apex and sides broadly, the middle of the median segment, the apex of the petiole broadly in the middle, and the other segments in the middle, the mark on the base of the second more dilated, black. Legs rufo-fulvous, the anterior with a more yellowish, paler tint; the apices of the tarsi darker, the hinder coxæ yellowish at the base, on the outer side at the apex marked with black and the apex of the femora black. Wings hyaline, with a fulvous tinge, the stigma fulvous, the nervures blacker. ♀.

Length 15-16 mm.

*Hab.* Khasia. Coll. Rothney.

Antennæ rufous, darker towards the apex. Face and clypeus shining, impunctate, and bearing a few white hairs; the labrum fringed with long golden hairs. Palpi rufous,

pilose. Mesonotum impunctate, the base covered with short pubescence. The furrow at the base of the metanotum deep, black. The sides of the metanotum at the base oblique, the middle much more strongly transversely striated; the posterior median area in the middle irregularly longitudinally reticulated; the teeth are large, somewhat triangular. The top of the prothorax is more deeply and roundly depressed than usual. Propleuræ obscurely punctured at the base and apex; the base of the depression obliquely striated, the striæ being stronger above, where it is black all round. Mesopleuræ yellowish, the base and apex on the lower side black; below the tubercles is a striated belt. Abdomen smooth; the apex of the petiole on the lower side raised and finely transversely striated.

Resembles *X. nigrolineata* in form and coloration, but differs in the flatter scutellum, in the more depressed middle of the pronotum, and in the second abdominal segment not being striated.

*Erythrojoppa nigromaculata*, sp. n.

Long. 18 mm. ♀.

*Hab.* Khasia. Coll. Rothney.

This species agrees very closely in coloration with *E. ferruginea*, Cam., but differs in having the scutellum not pyramidal.

The fifteen or sixteen basal joints of the antennæ are ferruginous, more yellowish in tint towards the middle; the dilated apical joints are black. Head ferruginous, the clypeus and orbits with a yellowish tint; the face and the top of the clypeus punctured but not closely; the central raised part of the face is more strongly punctured than the sides. The front above is broadly but not deeply furrowed in the centre, and is there transversely striated. The apex of the clypeus slightly projects in the centre; the projecting labrum is smooth and has the apex fringed with long rufous hair. Mandibular teeth black. On the ferruginous thorax the following parts are black: the middle of the pronotum and of the propleuræ, the sides of the mesonotum in front, its apex, the scutellar depressions, the base of the median segment, the greater part of the posterior median area in the centre (the black part narrowed above), the apex of the segment all round, the base of the mesopleuræ, except at the top, a line under the tubercles, the apex at the middle coxæ, the base of the metapleuræ, its apex and more narrowly its lower edge. The scutellum is roundly convex and



is slightly raised above the level of the mesonotum; the lateral keels extend near to the apex, which has an oblique slope and is closely longitudinally striated. The raised areola and the base of the median segment in the middle are smooth and shining; the rest of the segment closely rugosely punctured and striated; the metapleuræ and the spiracular area are closely, strongly, obliquely striated. Legs coloured like the body; the apical two joints of the hinder tarsi black; the pubescence is short, and on the base (the coxæ particularly) is pale fulvous. Wings yellowish hyaline, the apex fusco-violaceous; the nervures and stigma black. Abdomen ferruginous; the apical half of the third more or less and the other segments entirely black; the postpetiole is depressed in the middle at the base; the centre is strongly longitudinally striated; the gastrocœli, except at the base, are smooth and shining; the second segment to near the apex is closely longitudinally striated.

*Xanthojoppa femorata*, sp. n.

Yellow; the ocellar region, the vertex behind it, the occiput, an oblique mark on the upper part of the orbits behind, not touching the eyes, the central furrow on the front, the mandibular teeth, the sides of the mesonotum broadly, a line in the centre, reaching from the base to shortly beyond the apex, the scutellar depression, the space at its sides broadly, the depressed space at the base of the median segment, the central area, its apex broadly, the middle of the propleuræ, the sides, upper part and apex more broadly of the mesopleuræ, the base and apical part of the metapleuræ, a short mark on the apex of the petiole, longer than broad, broad at the apex, gradually narrowed and rounded at the base, a larger mark, triangular at the base, the other segments broadly in the middle, black. Wings fuscous violaceous, paler at the apex, the stigma and nervures black. The middle tarsi have the apical four joints black; the outer half of the hinder coxæ, except at the base, the hinder femora, tibiæ, and tarsi deep black. ♀.

Length 12–13 mm.

*Hab.* Khasia. Coll. Rothney.

The basal fourteen or fifteen joints of the antennæ fulvous, the apical black, almost bare; the scape shining, bare. Mesonotum closely, but not strongly, punctured. Scutellum shining. Areola coarsely, irregularly, longitudinally reticulated; the posterior median area is more coarsely reticulated, the sides at the top are transversely, obliquely striated, the

apex is more coarsely transversely striated and with a stouter, transverse keel which projects at the edges into a stout triangular tooth. The upper part of the propleuræ smooth, the lower with curved striations on the basal half. Mesopleuræ punctured, except in the middle behind; in front of this it is striated. Metapleuræ stoutly, obliquely striated. Gastrocœli shallow, smooth, transverse, black. The abdominal segments are covered with short black hair, except the first.

*Acanthojoppa xanthopsis*, sp. n.

Length 13 mm. ♀.

*Hab.* Khasia. Coll. Rothney.

This species has a small, broader than long, areola as in *A. nigromaculata*, but it differs in the median segment not being marked with black and in the top of the scutellum being broader and more distinctly roundly incised.

Luteous, the face, clypeus, labrum, and mandibles, except their teeth, pale yellow; the antennæ from the 15th or 16th joints black. Face and clypeus covered with short white hair. The mesonotum is darker coloured and thickly covered with short black hair. Apex of clypeus roundly, but not deeply, incised; the hair on the basal slope is long, black, and thick. The basal slope of the median segment is smooth and with the keels short, not reaching to the base; the areola small, the base rounded, the apex transverse; the apical slope has the centre irregularly shagreened; the sides stoutly, transversely striated. Pro- and mesopleuræ smooth, the base of the metapleuræ irregularly and sparsely, the apical half obliquely, punctured. Wings hyaline, the apex slightly infuscated, the stigma testaceous. The abdomen appears darker coloured on the back from being thickly covered with short black hair. Gastrocœli shallow, deeper at the apex, which is wider than long and is aciculated.

*Acanthojoppa tinctipennis*, sp. n.

Luteous; the face, clypeus, inner orbits narrowly, the outer broadly below, yellow, the apex of the antennæ broadly black; the wings fuscous hyaline, the apical half darker, more violaceous in tint, smooth and shining, the mesonotum granular and closely covered with short black hair; the scutellum coarsely and closely punctured and thickly covered with fuscous hair; the sides strongly keeled, the apex above slightly depressed. Basal area of median segment closely and strongly punctured; the areola slightly longer than broad, its sides at the base rounded, the centre a little depressed; the apex slightly bent inwardly; the

apical slope thickly covered with long fuscous hair; the posterior median area closely, the lateral area more coarsely transversely striated. Pro- and mesopleuræ closely punctured, the former striated behind, the metapleuræ more closely and strongly punctured. Four front coxæ paler than the rest of the legs. Petiole smooth and shining; the sides at the apex punctured. Gastrocæli shallow, wide at the apex, the base with two or three keels. ♂.

Length 12 mm.

*Hab.* Khasia. Coll. Rothney.

A species closely related to *A. curtispina*, Cam., from which it differs in the wings being darker coloured throughout, in the areola being distinctly bounded by a keel behind and not coarsely transversely striated, and the recurrent nervure is received shortly behind the middle of the arcolet.

*Acanthojoppa varicornis*, sp. n.

Luteous; the face, clypeus, and mandibles pale yellow; the apex of the antennæ black, brownish below; the wings hyaline, the base with a fulvous tinge, the stigma pale testaceous, the nervures darker coloured. ♀.

Length 10 mm.

*Hab.* Khasia. Coll. Rothney.

Head smooth and shining, the face and clypeus sparsely covered with a short pile. The upper part of the thorax is darker coloured than the sides and is closely and uniformly punctured and covered with a microscopic down. Scutellum thickly covered with long black hair; the lateral keels stout, the apex roundly incised above. The basal three area of the median segment smooth, the rest closely and somewhat coarsely transversely striated; the areola is about as broad as long, its sides and apex straight, the base rounded; the teeth are about three times longer than broad. Mesopleuræ, except above, closely and indistinctly, the metapleuræ much more strongly, striated. The second abdominal segment is closely longitudinally striated between the gastrocæli.

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

*A Manual of Palæarctic Birds.* By H. E. DRESSER, F.L.S., F.Z.S.  
Part I. Published by the Author at 3 Hanover Square, W.  
12s. 6d. net.

UNDOUBTEDLY this manual, when complete, will fill a distinct gap in ornithological literature, for although the subject has been, at least partially, covered by Mr. Dresser's larger work on the 'Birds

of Europe,' the price of these splendid volumes places them beyond the reach of the majority of working naturalists.

The modest price at which this book is published makes it probable that a second edition will be called for. On the strength of this probability we venture to make a few critical remarks, which, if they be taken in the spirit in which they are offered, and acted upon accordingly, should add still further to the value of this work.

In the first place, then, we would have its pages brought thoroughly up to date. In the second, we feel that diagnoses both of families and genera should be given. Further, we must say that Mr. Dresser's book, as it at present stands, is too eclectic. He gives no reasons for the faith that is in him when rejecting the claims of certain forms to subspecific rank, and admits others in a somewhat dogmatic fashion difficult to understand.

*The Fauna and Geography of the Maldive and Laccadive Archipelagoes.*

Part I. Vol. II. pls. xxvi.—xxxiv. Cambridge: University Press.  
15s. net.

THE first part of the second volume of this valuable work in every way sustains the high standard set by the earlier parts already noticed in these pages.

We would draw special attention to Prof. Hickson's report on the Aleyonaria of the Maldives, which will doubtless be read with keen interest by many who have hitherto paid little or no attention to this group. And for this reason, in the course of his report, Prof. Hickson shows, in the most luminous manner, how remarkable is the range of variation which a species may take in adaptation to an environment so variable as that of a reef.

"When I went out to Celebes," he says, "the first thing I did was to collect specimens of *Tubipora*, . . . [and] the conclusion I came to was that there is only one species, which varies on the one reef within limits almost as wide as the limits of all the hitherto described species of the genus." His remarks on the significance of the colours of *Spongodes* and *Solenocaulon*, for example, are of considerable interest, and may excite some surprise among those who insist on attaching a label explanatory of the meaning of conspicuous colours wherever they are met with.

There is much else in this report that we would fain note, but space forbids.

Sir Charles Eliot, in a paper on the Nudibranchiata, remarks that "It would seem as if the marine fauna of small islands which have never been connected with a continent is less in number and size than that of the mainland and its adjacent islands."

Mr. Laidlaw has a short paper on a Land-Planarian, which bears an additional interest since no Land-Planarian has hitherto been recorded from any coral island in the Indian Ocean.

Mr. Stanley Gardiner and Sir John Murray complete this part with an elaborate treatise on Lagoon deposits.



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# THE ANNALS

AND

## MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 70. OCTOBER 1903.

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XXXVII.—*Notes on Blattidæ &c., with Descriptions of new Genera and Species in the Collection of the British Museum, South Kensington.*—No. III. By W. F. KIRBY, F.L.S., F.E.S.

### BLATTIDÆ.

#### BLATTINÆ.

Genus MELANOZOSTERIA, Stål.

*Melanozosteria bicolor*, sp. n.

Long. corp. 18–20 millim.

Black, sometimes shading into dark reddish chestnut at the sides and towards the extremity; antennæ, palpi, and a large subquadrate spot on each side of the seventh abdominal segment above luteous. Tegmina lateral, just passing the extremity of the mesonotum, rather longer than broad, with the hinder angle rounded off; strongly punctured. Abdomen with the lateral extremities acutely angulated; the segments with numerous short, strongly marked, longitudinal carinæ at the extremities above. Tarsal joints more or less rufous; coxæ lined with pale yellow.

*Hab.* Torres Straits and Cornwallis Island.

Allied to *M. nitida*, Walk., but easily distinguished by its colour.

## Genus SYNTOMAPTERA, Tepp.

*Syntomaptera Tepperi*, n. n.

|| *Periplaneta glabra*, Tepp. Trans. Roy. Soc. S. Australia, xvii. p. 107 (1893).

*Hab.* Northern Territory of South Australia.

Judging from the description, this insect appears to be a species of *Syntomaptera*, Tepp. *Periplaneta glabra*, Walk. Cat. Blatt. B. M. p. 139. n. 45 (1868), belongs to *Melanozosteria*, Stål.

The name of the province known as "South Australia" is most misleading, and ought to be changed. It is really a perpendicular slice running from north to south of the whole continent.

## Genus METHANA, Stål.

*Methana Zehntneri*, n. n.

|| *Methana flavicincta*, Sauss. & Zehntn., Grandidier, Hist. Madagascar, Orth. i. p. 71, pl. ii. fig. 27 (1895).

*Hab.* Madagascar.

This species appears to be distinct from *M. flavicincta*, De Haan, from Java, of which Saussure and Zehntner consider it a variety. The true *M. flavicincta* from Java is smaller, and the yellowish markings on the middle of the pronotum are smaller and less conspicuous than in the insect figured from Madagascar.

*Methana rufescens*, n. n.

|| *Periplaneta pallipalpis*, Brunn. Syst. Blatt. p. 238. n. 18 (1865), nec Serv.

Long. corp. 17–18 millim.; exp. tegm. 38–41 millim.

Rufo-castaneous; head red, varied with blackish in front, but generally with a more or less distinct brighter red mark in the middle of the face below the limits of the antennæ, which are red towards the base and browner beyond; ocellar spots, palpi, and lower mouth-parts yellow. Pronotum elliptical, broader than long, with indistinct spots and streaks in the middle, obliterated in one specimen, in which the pronotum, except at the edges, is blackish. Meso- and meta-notum yellowish; abdomen pale red towards the base and mostly blackish towards the extremity; terminal segment long, slightly incised in the middle in both sexes; cerci long and thick, blackish, tipped with red; setæ of the female

nearly as long as the cerci. Underside blackish; legs dark red. Tegmina hardly as long as the abdomen, almost equally broad throughout; hind margin obtusely rounded, dark rufocastaneous, covered part of the right tegmen yellowish, more or less conspicuously bordered with rich purple. Wings with the costal area brown; nervures yellow in the basal half of the costal area and also the longitudinal nervures towards the base; the rest of the wing hyaline.

*Hab.* New South Wales.

Allied to *M. convexa*, Walk. (Cat. Blatt. B. M., Suppl. p. 152, 1869), from Moreton Bay, but in *M. convexa* the head is black. *Paraphoraspis* (?) *castanea*, Tepp. Trans. Roy. Soc. S. Australia, xviii. p. 173 (1894), appears to be another allied species.

### Genus BLATTA, Linn.

#### *Blatta Brunneri*, n. n.

||*Periplaneta concinna*, Brunn. Syst. Blatt. p. 229. n. 7 (1865).

*Hab.* Australia.

De Haan's description of his *Blatta* (*Periplaneta*) *concinna* (Orth. p. 50), from Java, appears to apply to *P. Borrei*, Sauss., which is in the British Museum, from Java and Hong Kong. It is a species of *Methana* allied to *M. pallipalpis*, Serv. Brunner's species thus falls under a different genus, and when a second species is described as the same as another, and they prove to be distinct, it seems to me that we have no alternative but to change the name of the later one, even though it may fall under another genus in which the name has not previously been used.

### Genus PELMATOSILPHA, Dohrn.

This is a small genus, but its contents do not seem to be very homogeneous; still I cannot venture to subdivide it, as I am unacquainted with the types, *P. alaris*, Sauss., and *P. præstans*, Dohrn. *P. marginalis*, Brunn., and the two other West-Indian species described below form a very natural group with short tegmina, while the Australian species will probably form another genus.

#### *Pelmatosilpha purpurascens*, sp. n.

Long. corp. 25–30 millim.

Head pale yellow above, brown below, with the sides and lower part sometimes varied with tawny. Antennæ ferru-

ginous. Pronotum and tegmina dark brown, with the borders broadly yellowish tawny, edged outside with a narrow black line. Tegmina overlapping, punctured, dark ferruginous brown, nearly half as long as the abdomen, truncated at the extremity, and broadly bordered with yellowish tawny; narrowly edged outside with a black line; the right tegmen, which is shorter than the left, is broadly bordered with yellow on both sides, and the dark centre passes on each side into reddish, which on the inner side is strongly flushed with purple in some lights. Legs pale yellow; hind femora double-lined with black beneath; hind tibiæ and tarsi more ferruginous. Abdomen black; lateral angles, cerci, and terminal plates ferruginous.

*Hab.* Dominica.

Allied to *P. marginalis*, Brunn., from Grenada.

*Pelmatosilpha decipiens*, sp. n.

Long. corp. 25 millim.

*Male.*—Head, pronotum, and tegmina orange-tawny; head with a broad blackish transverse band between the eyes, and a large blackish space varied with red on the middle of the front of the head, from above the antennæ to the extremity of the clypeus, except a pale space below each eye; pronotum with a narrow black rim all round and two black central spots, connected by a line between. Tegmina overlapping, closely punctured; costa bordered by a ferruginous line, closely punctured, squarely truncated and slightly waved at the extremities; right tegmen shorter than the left, about two fifths as long as the abdomen, which is tawny, with the segments bordered with black behind, increasingly, so that the hinder segments are almost entirely black. Legs tawny, with black spines, and the lower carinæ lined with brown or black. Antennæ ferruginous.

*Hab.* Trinidad.

Allied to the last species, but curiously resembling *Periplaneta australasiæ*, Fabr., in its markings.

*Pelmatosilpha* (?) *antipoda*, sp. n.

Long. corp. 25–27 millim.

Inky black, rather shining; antennæ (except at base), ocellar spots, a line on the coxæ, terminal joints of tarsi, and the pulvillæ pale yellow or ferruginous; pronotum nearly concealing the head, rather broad, semicircular, cut off square behind. Tegmina overlapping, of equal length, squarely truncated, but slightly concave at the ends, thickly punctured



and slightly inclining to ferruginous at the borders, about  $\frac{2}{5}$  as long as the abdomen. Front legs with a row of short spines beneath on the outer half; middle and hind legs with not numerous, but longer spines on their whole length.

*Hab.* Queensland.

I place this species provisionally in the American genus *Pelmatosilpha*, to which it has most resemblance.

### Genus DEROPELTIS, Burm.

#### *Deropeltis Saussurei*, n. n.

|| *Deropeltis longipennis*, Sauss. Mém. Soc. Genève, xxiii. p. 117 (1873).

This species is allied to *D. albilatera*, Stål (= *Wahlbergi*, Sauss., nec Stål). *Ischnoptera longipennis*, Walk. Cat. Blatt. B. M. p. 167. n. 29 (1868), appears to be synonymous with *D. brevicollis*, Serv.

### PANCHLORINÆ.

### Genus RHYPAROBIA, Karsch.

#### *Rhyparobia rufipes*, sp. n.

Exp. al. 63 millim.; long. corp. 38 millim.

*Female*.—Head black above, with two pale lines running downwards to a transverse pale band, below which a large blackish patch fills up the centre of the face as far as the lower border of the clypeus; pronotum black, with a narrow pale yellow border running all round. Abdomen yellowish at the base and blackish towards the extremity, except at the sutures. Under surface black, with pale yellow sutures; abdomen with a broad, central, interrupted, reddish band, and with curved, pale yellow, comma-like lateral markings. Legs red, spines tipped with black. Tegmina subparallel, about twice as long as broad, shorter than the abdomen, and obtusely rounded at the ends; greenish grey, with small, scattered, pale yellow dots. Wings broad, rather shorter than the tegmina; costal area purplish brown, with a few yellow spots towards the extremity; the rest of the wing brownish hyaline.

*Hab.* Sierra Leone.

Allied to *R. thoracica*, Kirby.

#### *Rhyparobia pallescens*, sp. n.

Long. corp. cum tegm. 40 millim.

*Female*.—Head, pronotum, and tegmina light shining yellowish grey; ocellar spots pale yellow, mouth-parts in-

clining to orange; antennæ blackish, shining. Pronotum elliptical, narrowed in front, with the sides obtusely angulated behind the middle. Tegmina with a conspicuous black basal line, as in *R. maderæ*, but not mottled. Body beneath chocolate-colour; abdomen with an orange-coloured comma, bordered within with black, near the sides of each segment; femora chocolate-colour or blackish, striped with yellowish white below; legs otherwise red.

*Hab.* Sierra Leone.

### Genus LEUCOPHÆA, Brunn.

#### *Leucophæa striata*, sp. n.

Exp. al. 35–43 millim.; long. corp. 20–25 millim.

Head free, light red above, black below, except a space under each eye and the parts below the labrum, which are pale yellow. Antennæ ferruginous, pale yellow at the base. Pronotum smooth, shining, sparingly punctured, more or less blackish in the middle; the front and depressed sides red; front transversely striated. Abdomen orange-tawny, paler below, with a row of four linear spots on each side. Tegmina reddish tawny towards the base, and yellowish towards the costa beyond the costal cell and towards the apex of the left tegmen; outer half of right tegmen obliquely, and wings clear hyaline; outer half of costa of wings yellowish tawny.

*Hab.* Selangor, near caves (*H. N. Ridley*).

Allied to *L. tenebrigeræ*, Walk., from India.

### Genus PANCHLORA, Burm.

#### *Panchlora translucida*, n. n.

|| *Panchlora hyalina*, Sauss. Rev. Zool. (2) xiv. p. 231 (1862); Sauss. & Zehntn. Biol. Centr.-Am., Orth. i. p. 96. n. 12 (1893); Brunn. Syst. Blatt. p. 275. n. 6 (1865).

*P. hyalina*, Stoll, Spectres, Blatt. p. 5, pl. iii d. fig. 12 (1813), appears to be identical with *viridis*, Burm., Sauss. & Zehntn., Brunn. (nec Fabr., which = *nivea*, L.); *nivea*, Herbst, Thunb., Sauss. (nec Linn.); and *Poeyi*, Sauss.

### Genus NAUPHÆTA, Burm.

#### *Nauphæta basalis*, sp. n.

Exp. al. 52–56 millim.; long. corp. 28–30 millim.

*Female*.—Head black, a tawny band in front, curving round behind the eyes to the vertex; a space between each

eye and the mouth-parts tawny. Pronotum with the sides rounded, hinder border quite straight, black, with the sides bordered with pale yellow. Abdomen above brown, shading into black, the sutures and margins pale yellow; cerci black, tipped with red. Underside banded with black and tawny; legs ferruginous, coxæ and femora pale yellow beneath. Tegmina of a shining and slightly reddish brown; a pale yellow line on the costal margin, below which the costal cell is black; anal area with a large, oval, pale yellow spot at the base. Wings brownish hyaline, with the costal area brown.

*Hab.* Matton Mountains, Tonkin, April and May (*H. Fruhstorfer*).

This species has a superficial resemblance to *Hedaia olivacea* &c., but the unarmed femora, and pronotum truncated behind, will at once distinguish it.

### *POLYPHAGINÆ.*

Genus *POLYPHAGA*, Brullé.

*Polyphaga limbata*, n. n.

|| *Homæogamia sinensis*, Sauss. Mém. Soc. Genève, xxi. p. 282 (1869);  
Rev. Suisse Zool. i. p. 311 (1893).

This species is quite distinct from *P. sinensis*, Walker & Dohrn, to which the specific name rightly belongs, but which Saussure has renamed *H. Dohrniana*.

*Polyphaga camelorum*, Kirby.

*Polyphaga camelorum*, Kirby. Ann. & Mag. Nat. Hist. (7) xi. p. 407 (1903).

Jacobsen and Bianchi have described and figured this species from Turkestan, but have identified it with the much smaller *P. ægyptiaca*, L. (Premokr. i Lozhn. Ross. Imp. p. 133, pl. ii., 1892).

### *PLECTOPTERINÆ.*

Genus *PROSOPLECTA*, Sauss.

*Prosoplecta rufa*, sp. n.

Long. corp. cum tegm. 9 millim.; lat. 5 millim.

*Female*.—Light red, the tegmina somewhat darker. Pronotum smooth and shining, with the front border narrower than the hind border, transversely oval, with broad borders of subhyaline yellow covering the rounded off lateral angles, and

the hind border yellow. Tegmina with the costal margin subhyaline yellow, a small yellow spot near the base, and another at one third of the length, both near the costa; between the second and the inner margin is a much larger, transverse, oval, yellow spot. Base of tegmina blackish. Wings, and a great portion of the middle of the abdomen beneath, as far as the base of the terminal segment, black.

*Hab.* Mindanao, Philippines.

*PERISPHERIINÆ.*

Genus *THYSANOBLATTA*, nov.

*Male*.—General characters of *Derocalymma*, Burm. Pronotum regularly curved, longer than broad, semioval, with a broad depressed channel before the raised marginal line; hood below with the sides moderately broad, narrowing on each side to a point in front, the central part over the head almost linear. Pronotum clothed with long hair above, which forms a fringe all round, except on the hinder edge. Eyes approximating; front femora with three short spines below, and a terminal spine above; hind tibiæ with three rows of spines above.

Differs from *Trichocoma*, Stål, in the shape of the pronotum, which in Stål's genus is described as being wider before than behind.

*Thysanoblatta latipennis*, sp. n.

Long. corp. 18 millim.; exp. al. 45 millim.

*Male*.—Pronotum black, rugose-punctate, with a very slight median carina, most distinct behind; the channel within the recurved marginal line broad, smooth, reddish; the recurved edge brown at the sides; hind border of pronotum narrowly brown, pronotum clothed and fringed with long ferruginous hair. Hood moderately broad, punctured, contracted to a line in front; ocelliform spots very large, pale yellow; eyes closely approximating, the line between, and the front orbits and lower mouth-parts, testaceous; the rest of the face black, distinctly punctured. Antennæ black, testaceous towards the base. Abdomen and under surface lighter or darker testaceous, the abdomen blackish towards the extremity above, and towards the sides and extremity beneath; cerci pale yellow, base of coxæ and a more or less distinct line on the femora black. Tegmina narrow, yellowish hyaline, the costal area and base of the inner margin whitish; basal fourth opaque, reddish brown, shading into black at the base;



longitudinal nervures and cross-nervures just beyond the opaque part of the tegmina and to beyond the middle below the costal area rufo-testaceous, the rest of the cross-nervures white. Wings broad, as long as the tegmina, hyaline, and with white nervures, except that the longitudinal nervures and the branches of the subcostal nervure are pale brown.

*Hab.* Mbuyuni, Brit. East Africa (*Betton*).

This insect agrees fairly well with *Ischnoptera macra*, Stål, but is twice the size; from *Derocalymma versicolor*, Burm., it differs in the colour of the legs &c. Both these species may, perhaps, belong to the present genus. The female probably resembles *Perisphæria æqua*, Walk., or *Derocalymma Brunneriana*, Costa; but there is no reason to identify the male here described with either of these species.

### PANESTHIINÆ.

Genus PANESTHIA, Serv.

*Panesthia nigricans*, n. n.

|| *Panesthia nigrita*, Sauss. Rev. Suisse Zool. iii. p. 317, n. 17 (1895).

*Hab.* Macassar.

Not *Blatta nigrita*, Stoll, Spect. Blatt. pl. ii d. fig. 6.

XXXVIII.—On the Origin of Bacteria and their Allies by Heterogenesis\*. By H. CHARLTON BASTIAN, M.A., M.D., F.R.S.

[Plates XXV. & XXVI.]

IF we turn to the question of the origin of Bacteria and their allies by heterogenesis we shall find, I think, that the evidence is overwhelming in regard to its reality, though it lacks that kind of certitude which obtains in regard to the heterogenetic origin of some much larger organisms whose birth from strange ancestors we have been following in some of the preceding sections. We may, for instance, as I have shown, see the whole substance of a large Rotifer's egg segment into a number of smaller parts, and we may see such segments presently become active as Amœbæ, Monads, Peranemata, or even as Ciliated Infusoria†.

\* This paper forms one of the concluding sections of the author's 'Studies in Heterogenesis.'

† See 'Studies in Heterogenesis,' pp. 31 & 46.

But this kind of proof is impossible in the case of Bacteria. Where the proof is most direct (even where the birth of Bacteria seems to take place under our eyes) it must always be a question of particles of living matter emerging from the region of the invisible—appearing, that is, where previously visible particles were absent. While in other cases, without being so directly present as it were at their birth, we may find them existing in parts of animals or plants, after these have been subjected to certain experimental conditions, where previously, in accordance with all existing knowledge and belief, neither they nor their germs are to be found. They may appear, that is, when such animals or plants, or, rather, portions of them, have been exposed to certain experimental conditions unfavourable to their pre-existing vital processes, but which yet, as we assume, allow the constituent protoplasm to die more or less slowly, and portions of it to individualize themselves and grow into this or that form of microorganism.

The assumption here is that we have, as starting-points, to do with pre-existing units of living matter. Still, in the cases where our observations are made upon protoplasm which appears to be actually structureless, or upon one or other of the fluids pertaining to an animal or plant, the actual mode of origin, so far as appearances go, may be precisely similar to that which would occur in archebiosis; in each case there would be the appearance of particles where none previously existed. The difference between the two cases would be this: in archebiosis we should have to do with the actual birth of units of living matter, with a synthesis, that is, from its elements; but in the case of heterogenesis we have confessedly to do with living matter already existing, so that we postulate only an individualization of living particles or of larger units, together with a change in their mode of life.

Where the particles of living matter so individualizing themselves are so small as to be beyond the range of our most powerful microscopes, it would be impossible to say, as they grow and become recognizable in organic fluids, whether newly appearing particles had arisen by heterogenesis or by archebiosis. On the other hand, it must be recognized that there are particles of various kinds in the tissue elements and fluids of an animal or plant which it is often impossible by mere microscopical examination to discriminate from germs of microorganisms. And until such germs begin to grow and assume specific shapes, or particular collocations, their discrimination from particles which are normal constituents of such tissues or fluids cannot safely be made.

Whenever, therefore, Bacteria or their allies appear in the midst of the tissues or fluids of animals or plants, two possibilities have to be considered in order to account for their presence. The two questions that have to be asked are these:—

(a) Are the bodies of plants and animals interpenetrated in all parts by invisible germs of microorganisms, or are they germless?

(b) Have the microorganisms which may be found in the tissues or fluids of plants and animals under various conditions been produced therein by heterogenesis (possibly in the fluids by archebiosis), or is their presence invariably to be ascribed to infection from without?

(a) During the last thirty years it has been commonly held, in accordance with the teachings of Pasteur, Lister, and others, that the tissues and fluids of healthy animals and plants are germless and altogether free from microorganisms.

In regard to animals, however, it is clear that this position is one which cannot be accepted without very important limitations. It is obvious that microorganisms may, like other particles, get taken up from the mucous membranes of the alimentary canal and the respiratory system, and pass by means of lymphatics into the nearest glands. If they should get through these and ultimately pass into the blood, the generally accepted view is that they are speedily destroyed in this fluid. This view is based upon the fact that bacteriologists are never able to get evidence of the existence of microorganisms or their germs by the inoculation of different suitable and sterilized media, with blood drawn from a healthy man or from one of the lower animals similarly free from disease.

Yet, although the blood and internal tissues of healthy animals and of man are declared to be free from microorganisms and their germs, such organisms will habitually show themselves after death, in the course of a few days, throughout all the organs, even when life has been abruptly terminated in a state of health. It cannot reasonably be said in explanation of this that the organisms naturally present in the intestinal canal have been enabled to spread through the body so as to reach the most remote parts *after death*, since many of the organisms are motionless and others exhibit mere to-and-fro movements of a non-progressive character. The blood, again, has ceased to circulate, so that this fluid, germless during life, cannot after death be considered to act as a carrier. But if the organisms themselves cannot make their way through the tissues and travel far

within brief periods, and if no carrier exists, they must naturally have been born in or near many of the sites in which after death they are speedily to be found.

If bacteriologists are right in their view that the blood is germless in healthy animals because any germs or organisms obtaining access thereto are straightway killed, there seems no escape from the foregoing conclusion.

It has, however, been held by Tiegel, Burdon Sanderson, and others that though the blood is germless, "those parts of the animal body which are in closest proximity to absorbing mucous membranes are most liable to be found pregnant with microphytic life when tested by suitable methods"\*. Their experiments showed, indeed, that such organs as kidney, spleen, and liver, when removed from the body of a healthy animal immediately after its death and suitably treated, could always be made to reveal the presence of microorganisms.

But cutting out portions of internal organs of recently killed animals, enveloping them with superheated paraffine, and then placing them in an incubator at a suitable temperature, followed by the finding of swarms of Bacteria in the central red and uncooked portions is not a method that can possibly give us certain information as to the mode of origin of the organisms found. It may be, as Burdon Sanderson and others concluded, that the organisms found came from "germs which existed and retained their latent vitality in the living tissues"; but it is equally possible, as I maintain, that they may have had a heterogenetic origin within these tissues themselves.

It seems perfectly clear that experiments of this kind, if carried no further, could teach us nothing decisively, that their results, in fact, are of no more value than those that may be obtained by the examination of the brain and its membranes three or four days after a healthy animal has been killed. There also swarms of microorganisms would be found, as I can testify; and if bacteriologists are right that organisms and their germs are, as they say, "destroyed" in the blood, we could only conclude that the organisms so found must have been produced by archebiosis or by heterogenesis.

In regard to plants—that is, fruits and vegetables of different kinds—the case is not so complicated, and Pasteur may have been perfectly right in declaring that, when healthy, their tissues are germless. Thus, in considering the interpretation of cases in which microorganisms are found in the

\* Brit. Med. Journal, 1875, vol. i. p. 199; see also 1878, vol. i. p. 119.



interior of certain vegetables or fruits after they have been submitted to various unnatural conditions, the question will not be whether we have had to do with the wakening up of latent pre-existing germs, but rather whether the organisms found are results of an infection that has recently been brought about—that is, during the exposure of the vegetables or fruits to the experimental conditions. And this brings us to the consideration of the second of the two possibilities above referred to.

(b) The second possible mode of accounting for the presence of microorganisms in the tissues of healthy animals and plants is that they have resulted from some process of infection brought about antecedently or during the continuance of the experimental conditions to which they have been subjected\*.

It is of great importance for the proper consideration of this possibility that we should have some definite knowledge as to the power possessed by such microorganisms as *Bacteria* and their allies of penetrating the healthy tissues of plants and animals, as to the means by which they are enabled to do so, as well as concerning the time needed for such an operation. Fortunately one such investigation, very much to the point, can be referred to.

M. C. Potter† has carefully investigated a bacterial disease of the turnip which he calls “white rot,” due to infection by an organism named *Pseudomonas destructans*. He shows that this Bacterium “secretes an enzyme which dissolves the middle lamella and causes the softening and swelling of the cell-wall,” and also a toxin. Later, he enters into details as to the mode in which the Bacterium attacks and penetrates the cells of the turnip, the latter process being actually seen ‡. These later observations were made upon a small fragment of turnip inoculated with a pure culture of *P. destructans* and introduced into a hanging drop. The influence of the Bacteria was very rapidly brought about. One particular cell attacked by the Bacteria was watched; a wall common to it and the next was measured, and after half an hour it was found to be nearly twice as thick as before; in another twenty minutes it was nearly three times

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\* I say “antecedently,” because the explanation favoured by Burdon Sanderson of the finding of swarms of Bacteria in kidney, spleen, and liver in his experiments previously referred to is some process of infection from the alimentary canal. How the infection is brought about he does not think it necessary to explain (see Brit. Med. Journal, 1878, i, p. 120)—that is, how the Bacteria (not to speak of their germs) could penetrate all the coats of the intestine and the capsules of the abdominal organs; nor why, if Bacteria or their germs could be active enough and have the power of effecting such a migration, they should, on arrival in this or that organ, lose all their activity and pass into a “latent condition.”

† Proceed. of Roy. Soc. vol. lxvii, p. 442.

‡ Loc. cit. vol. lxx, p. 392.

as thick; in an hour and a quarter from the commencement the two parts of the cell-wall began to separate, and in another quarter of an hour there was a distinct gap between them. By this time also all the protoplasm had separated from the cell-wall and formed an irregular bag in the centre of the cell, owing to its death under the action of the toxin. "After this the changes were less rapid, and beyond a slight further separation of the cells, a *more rotten and watery appearance of the cell-wall* was all that could be observed." Contiguous cells were being attacked in the same manner.

"The Bacteria continued swarming around the cell-walls," the author says, "and next morning (by which time the cells had been destroyed several layers deep) many Bacteria had come to rest in contact with the wall, their long axis being perpendicular to its surface, and one or two had the appearance of being imbedded in the wall as if in the act of boring their way through." The actual penetration of the wall was subsequently watched on several occasions. "The time required varied with the thickness of the wall, but on an average occupied about three hours." But Potter found that this Bacterium had "no power to penetrate the cuticle of the mature epidermis of the turnip"; it was also incapable of penetrating the epidermis of mature leaves, the fully developed cuticle being proof against the action of the enzymes excreted by *P. destructans*, though young leaves from the growing points "possessing little or no cuticle" were found to be vulnerable.

The important facts made known by this research are therefore these:—the vegetable cell is only capable of being penetrated when its walls are not thick and hard originally, and when they have been extremely softened by long contact with the cytase excreted by a number of Bacteria. The need of a conjoint attack is distinctly indicated by the author, who says \*:—"Very soon the number of individual Bacteria becomes largely increased, each one contributes its share of toxin and cytase, and in a very short time these products have sufficiently accumulated to kill the first cell. . . . It is not, however, until the protoplasm has been killed and the cell-wall very much softened that the Bacteria have the power of perforating the walls and passing into the cell-cavity. It would hardly be supposed that a single Bacterium, through its own excretions, could soften the wall and pierce it at one definite point after the manner of a fungus germ-tube. The extreme minuteness of the Bacteria and the rapidity of their multiplication lead them to act, as it were, in concert, and the wall becomes softened by the cumulative action of many Bacteria before the penetration of a single individual."

The mode in which a Mould infects and penetrates a vegetable cell is very similar, allowance being made for its greater size, which permits a single individual to do what can only be brought about by numbers of organisms in the case of Bacteria. This subject has been recently investigated by Nordhausen † while studying the parasitism of *Botrytis cinerea*. I quote from Potter, who says:—

"He has shown that the spore of this fungus excretes a powerful toxin in its initial stages of germination before any trace of the germ-tube can be detected. Its manner of effecting an entrance into a host-plant is first to kill the cell by the emission of the toxin; the germ-tube then penetrates the dead cell, and is nourished saprophytically upon it; with the vigour thus gained it destroys the neighbouring cells and passes from one

\* *Loc. cit.* p. 395.

† Jahrbücher für Wissensch. Botanik, vol. xxxiii. (1899).

to another without further difficulty. The fungus hypha has the power of penetrating the cuticle, *but only in young and tender structures*; old and hardened membranes could only be entered when the cuticle had been injured or when it had gained strength by special saprophytic nutrition."

These results will prove important as standards for comparison with others to which I am now about to refer\*. We have seen that in the case of actual infection by Bacteria there is need for the co-operation of many organisms in order to bring about, by their secretions, the softening of the wall of every single cell that is penetrated, that some time is required for the operation, and that the softening produced must be considerable before any such penetration is possible. It will be seen how very different is the state of things in cases which I shall cite as instances of the origin of Bacteria and their allies in the tissues of plants and animals by a process of heterogenesis.

The presence of two characteristics, wherever they coexist, may be regarded as strongly in favour of the interpretation of heterogenesis as against infection, as the following remarks will show.

(1) The means adopted by Bacteria for bringing about the penetration of cells are such as are associated with the vital processes of adult organisms. So that there is no reason to think that invisible or scarcely visible germs of such minute organisms would have the power of secreting a cytase sufficient in amount to bring about that degree of softening of a cell-wall which has been found to be a necessary preliminary to their penetration. *Yet in multitudes of cases it is minute germs of Bacteria and their allies which may be seen developing within cells or tissues.*

(2) Again, the process of infection, as described by Potter, is one brought about by active organisms which affix themselves to a cell-wall until it becomes softened, and then succeed, by reason of this same activity, in boring their way into the cavity of the cell. On the other hand, in very many of the cases in which, as I maintain, Bacteria and their allies may be presumed to be originating by heterogenesis, what can often be seen is this—particles becoming visible in the midst of homogeneous protoplasm, such particles being invariably motionless, but followed soon by the appearance of definite Bacteria or their allies, recognizable as such by their shapes and modes of collocation. *But these Bacteria or their allies,*

\* As well as with the case of assumed migration and infection referred to on p. 385, note \*.

*like their germs, are invariably, at first, found to be motionless.* This primary motionless condition is, in fact, the rule in the case of organisms taking their origin by heterogenesis. Thus, when Monads are formed in the pellicle on a hay infusion, they are at first motionless; when *Amœbæ* or *Actinophrys* are developed from the substance of large Confervoid cells or from resting-spores of *Spirogyra*, and again when *Amœbæ*, Monads, *Peranemata*, or Ciliated Infusoria arise from the transformations of the substance of the egg of this or that Rotifer—in all these cases also the resulting organisms are at first motionless\*.

These two points are therefore of great importance. For the purpose of interpretation it should be borne in mind that in cases of Infection by Bacteria and their allies we have to do with *adult organisms in a state of activity*, while in cases where Heterogenesis may be presumed to be occurring we have invariably, in the first place, to do with *germs and motionless organisms*†.

I shall now proceed to mention some instances in which it seems clear that Bacteria and their allies have arisen by heterogenesis. I make a selection for this purpose of a few typical cases out of many others which I might have cited.

Bacteria may constantly be seen developing in the way I have mentioned within the living cells and filaments of various Algæ. In *Vaucheria* and in *Spirogyra* this is commonly to be seen where the plants have been kept in unnatural conditions for a time—shut up, for instance, either in a cupboard or within a stone pot. In the case of *Vaucheria* they may often best be recognized in and near the growing points of the filaments, where they show themselves first as mere motionless specks, which gradually develop into Bacilli, and, after a time, take on an active existence. In the filaments presenting these appearances the wall may appear quite healthy, showing no signs of softening, nor is there any indication whatever of the penetration of Bacteria from without. The development of Bacteria within the cells of *Spirogyra* may be best seen in cases where the endochrome is not very abundant and the cells are small. Motionless, colourless particles seem to bud from the edges and surface of the bands of endochrome, and some of these gradually take

\* See my 'Studies in Heterogenesis,' pp. 5, 8, 10, 31, 46, 69.

† Of course by "germs" I mean here merely minute and undifferentiated stages of the organisms in question, produced by heterogenesis, and not the ordinary acceptance of the word, viz. a reproductive unit formed in an organism of like kind.



on the forms of Bacteria and begin to exhibit swarming movements. This may be commonly seen in cases where the cell-wall presents a perfectly healthy appearance and where there is absolutely no indication of infection taking place from without.

The same kind of thing is often to be observed within the thick-walled resting-spores both of *Vaucheria* and *Spirogyra*. There is the appearance of motionless particles in some part of the spore, the appearance of Bacteria in the midst of these particles, and the gradual assumption by the Bacteria of swarming movements. Observations of this kind were not unfrequently made in cases where these resting-spores had been undergoing one or other of the changes that I have previously described.

Again, I have occasionally seen a development of motionless Micrococci and Bacilli taking place inside the thick wall of a *Nitella* cell, between it and the chlorophyll layer, such as is shown in Pl. XXV. fig. 1 ( $\times 700$ ). Yet the normal cyclosis was still going on within this cell, showing that there could be no apertures or solutions of continuity of any kind; and all the microorganisms to be seen in different stages of development in this layer were quite motionless, so far as could be observed. Their imperfect definition in the photograph, however, makes it possible that absence of spontaneous movement was not absolute, unless the slight blurring may have been due to vibrations during the prolonged exposure needful to enable the light to pass through the whole thickness of the filament. Their appearance along a particular band of the filament only is, of course, due to the parts on either side being out of focus.

I have also endeavoured to throw light upon this question in another way, that is, by repeating, with variations, some of the experiments of Lechartier and Bellamy, by which they studied the fermentation that occurs in various vegetables and fruits when shut up within hermetically sealed vessels. They showed that the oxygen of the air was soon consumed by the vegetables or fruits, which then began to break up sugar, to give off carbonic acid, and to produce alcohol and acetic acid. They came to the conclusion in 1872 \* that this fermentation might certainly occur without the production of the alcoholic ferment. They, in fact, adopted Pasteur's view that the formation of alcohol in these cases was due to the altered activity of the cells of the fruit, which, in the absence of free oxygen, act after the fashion of ferments. In a later

\* Compt. Rend. 1872, ii. p. 1203.

communication, however, these investigators stated \* that in their experiments with potatoes and beetroot, while alcohol and carbonic acid were produced in the same way as with the fruits, and the alcoholic ferment was absent as before, Bacteria of different sizes were invariably found in the acid fluid which impregnated the softened tissues of the vegetables in question. No details on this point were given, and the authors do not appear to have made any further observations on the subject; nor did Pasteur offer any reply to such statements, though he had, about this time, been working at the subject himself †.

Having determined to endeavour to obtain some more definite information as to the appearance of Bacteria in this way, I have, during the last two or three years, made various experiments in which, after small *Potatoes* had been carefully washed they were allowed to soak for a time in different germicidal fluids. First of all I employed a solution of mercury bichloride (1 : 2000); while later, after the preliminary washing, the potato was allowed to soak in a 5 per cent. formalin solution. The screw-top bottle in which the potato was placed was also thoroughly washed out with one or other of these fluids. In these cases organisms were found within, but also after a time on the surface of, the potatoes thus treated; so that these particular experiments and methods were rejected as not yielding trustworthy results. This was necessary because at a rather earlier date Pasteur had stated ‡ that in experiments which he had made with many fruits no ferment-organisms ever appeared. He declared again that the tissues of healthy fruits and vegetables were germless, but intimated that unless care was taken they might make their way in from without.

Subsequently I used a stronger solution of formalin, and have never since found organisms on or near the surface, though they have often been found within cells in the central portions of the potato. I will now, therefore, give brief details of some of these experiments.

In July, 1901, after well washing a small new potato it was allowed to soak in a 10 per cent. solution of formalin for ten minutes, in a small screw-top bottle, and during this time the fluid was frequently shaken so as to cover the whole inner surface of the bottle. At the expiration of the time named the top was unscrewed, the fluid poured out, and the top then tightly refixed, leaving the potato itself and the inner surface

\* Compt. Rend. 1874, ii. p. 1006.

† *Loc. cit.* 1872, ii. p. 788.

‡ *Tom. cit.* pp. 788 & 981-2.

of the bottle wet with the formalin solution. The bottle was subsequently left in a cupboard for seventeen weeks, the temperature of which for a long time remained about 70° F., although it afterwards fell to 55° F.

When removed from the bottle at the expiration of this time the potato was found to be quite firm and not at all shrunk. On section it was seen to be discoloured to a pale earthy tint, with mottlings here and there of a rather darker colour. The cut surface was moist and had a distinctly acid reaction, and there was not the least sign of softening or disintegration anywhere. Thin sections having been made, they were shaken up in a small tube with distilled water, so as to get rid of the starch-grains from many of the cells, and the sections were subsequently allowed to soak in some of Westphal's mastzellen stain, diluted with 2 per cent. formalin, for two hours.

On microscopical examination of these sections groups of Bacteria were found in large numbers of the cells, and everywhere except in those near the surface. The contents of one of these cells is shown in Pl. XXV. fig. 2, B ( $\times 500$ ); some of the Bacteria were free and others were in or lying on the primordial utricle, but, as I have usually found with micro-organisms in such situations, they were not appreciably stained. Some cells, which did not contain obvious Bacteria, showed plenty of minute cocci-like bodies on the surface of the primordial utricle, also not taking the stain, which probably represent early stages of the Bacteria (fig. 2, A,  $\times 700$ ).

Another larger potato, about two inches in diameter, was treated in exactly the same way as the last, in September 1901, and after the bottle was finally closed it was left on the surface of an incubator at a temperature of about 80° F. for seven weeks.

When examined the potato was not found to have shrunk or to be appreciably altered on the surface. On section it was moist, of acid reaction, and showed as before a pale earthy colour with rather darker mottlings.

Sections were made and treated in the manner previously indicated, and on examination multitudes of Bacilli were seen here and there in cells in all parts of the section except for about one fifth of an inch from the surface. In places also there were fine mycelial filaments containing spore-like bodies. Some of these Bacilli took the stain fairly, as may be seen in Pl. XXV. fig. 3, A ( $\times 500$ ), in which the two kinds of organisms are shown. In or on the primordial utricle also there were multitudes of very delicate interlacing filaments (? Bacilli), containing an abundance of spores which had

taken the stain freely, as may be seen by Pl. XXV. fig. 3, B ( $\times 500$ ).

In November, 1900, a small new potato had been treated in the same manner that I have already described, but after pouring away the 10 per cent. formalin solution the bottle was filled with carbonic acid gas before screwing on the top\*. This bottle was then placed within an incubator and allowed to remain there at a temperature of  $84^{\circ}$  F. for six weeks.

On examination the appearance of the potato externally and internally was almost exactly such as I have described in the others. There was the same mottled colour of the cut surface, with a rather deeper tint in the centre as well as in some other parts.

Sections of the central portions of the potato were made and placed for a short time in a carbo-fuchsine solution. On microscopical examination in many of the cells very small mycelial filaments (something like *Crenothrix* filaments), with spore-like bodies at intervals, were found, such as are shown in Pl. XXV. fig. 4, B ( $\times 500$ ). The filaments were lying on the primordial utricle, and, as in many other cases, the organisms had scarcely taken the stain at all. In other cells what seemed like the beginnings of such organisms, or of others very similar, were found on the surface of the primordial utricle, as shown in Pl. XXV. fig. 4, A ( $\times 500$ ).

At the end of March 1903 I made another slight variation in the conditions, and again obtained a rather different result. A small new potato, after careful washing, was placed in a small tin with a very tightly fitting cover and allowed to soak in 10 per cent. formalin for twenty minutes, the fluid having been shaken about several times so as thoroughly to wet the whole internal surface of the tin. The fluid was then poured off, leaving the surfaces wet with the solution as before; the tin cover was very tightly jammed down and the vessel was again placed within a copper incubator at a temperature of  $75^{\circ}$  F., and allowed to remain there for eight weeks.

When taken out and examined the cut surface of this potato presented just the same characters as in the others: the whole substance was firm throughout, there was no shrinking, and the central portion was rather darker than the other parts, which showed the usual mottling.

Sections were made, shaken up in distilled water in a small tube as before, and then placed for a short time in a dilute gentian-violet solution. On microscopical examination a

\* The filling the vessel with  $\text{CO}_2$  was a method adopted by Pasteur in his experiments on the fermentation occurring in fruits contained in closed vessels.



large number of the cells scattered throughout the sections were found to show the most delicate branching tufts of a new kind of microphyte, probably a species of *Cladothrix*, which had taken the stain slightly, and such as are shown in Pl. XXV. fig. 5 ( $\times 500$ ). These tufts were mostly seen to be sprouting from the external surface of the primordial utricle where it had shrunk away from the cell-wall. No Bacteria and no ordinary Mycelia were found in either of the sections, though they were most carefully examined.

A few experiments have also been made with small *Turnips* about two inches in diameter, to two of which I will now refer.

A perfectly sound turnip of the size mentioned was, in November 1901, first well washed in water and then allowed to soak in a screw-top bottle in a 10 per cent. formalin solution for ten minutes. It was subsequently treated in exactly the same manner as the potatoes had been. After the top of the bottle had been tightly screwed on, it was left on the top of the incubator at a temperature of about  $80^{\circ}$  F. for seven weeks.

On examination at the expiration of this time, the turnip was found to be somewhat shrivelled in its upper two thirds. The odour of the bottle was disagreeable and pungent, though slightly aromatic and spirituous. The odour was so strong that it did not seem likely that the shrivelling was due to evaporation, owing to the screw-top not having been quite air-tight.

On section the rather shrivelled upper two thirds was found to be much discoloured and honeycombed, the lower third being much less so. Sections were made and soaked in dilute "mastzellen" stain; and on examination cells here and there, not continuously, but in the upper and lower portions alike, were found to be crowded with very minute Bacteria, most of which took the stain only slightly. In Pl. XXV. fig. 6, A ( $\times 500$ ), a large aggregate of these organisms is to be seen, with others scattered about over contiguous portions of the section.

Another small turnip of the same size as the last was, at the same date, after being well washed, placed in a screw-top bottle and stood on a small earthenware pot, in order to protect it from actual contact with 6 drachms of pure formalin which had previously been poured into the bottle. The top was then tightly screwed on, and the bottle was placed on the incubator by the side of the other at about  $80^{\circ}$  F., where it

remained for eight weeks, the turnip being in an atmosphere saturated with formalin vapour.

On examination this turnip was likewise found to be slightly shrivelled, and it was rather soft and doughy to the touch. On section the colour was almost natural, except for a depth of about one third of an inch round the periphery, where it was slightly discoloured, and in the centre, where there was a small area about one quarter of an inch in diameter which had a rather gelatinous appearance.

Two sections through this central region and its neighbourhood were made, and then soaked in dilute "mastzellen" stain. On microscopical examination they were found to contain moderately large Bacteria, mostly in small groups, in a large number of the cells; though here and there larger masses of Bacteria were found, such as are shown in Pl. XXV. fig. 6, B ( $\times 500$ ). In many of the cells the Bacteria seemed to be developing in and on the surface of the primordial utricle, and also in and on the surface of the nuclei of the cells.

I have made only one experiment of this kind with an *Apple*, and in this case a rather small, but thoroughly sound, specimen was placed in a screw-top bottle, and stood on a small earthenware pot as before, so as to remove it from contact with some pure formalin which had been placed in the bottle. The top was tightly screwed on, and the bottle was then placed in a cupboard, where it remained for eight weeks—the temperature of the cupboard varying during this time between  $70^{\circ}$  and  $56^{\circ}$  F. The apple was thus left, as the turnip had been, in an atmosphere saturated with formalin vapour\*.

On examination the surface of the apple was found to be hardened, and on section irregular patches of brownish discoloration were seen; otherwise nothing abnormal was observed.

Microscopical examination of an unstained section showed, in a few of the cells, a small Fungus mycelium, such as may be seen in Pl. XXVI. fig. 7, A ( $\times 250$ ). Specimens like this were found in cells in different parts of the section, though in the great majority of them nothing of the kind was met with.

\* I have not had many successes with this method, and do not recommend it, especially as the soaking for a time in 10 per cent. formalin has proved to be perfectly sufficient to guard against external contamination. It is difficult to tell how far the formalin vapour penetrates into the substance of fruits or vegetables left in an atmosphere saturated with it for many weeks.

When present the growth seemed to start from the cell-wall close to the nuclei, if not from the nucleus itself. No Bacilli were seen; but in some cells what appeared, judging from their uniform size and mode of arrangement, to be a number of Micrococci were found on the primordial utricle, such as are shown in Pl. XXVI. fig. 7, B ( $\times 375$ ). They scarcely stained at all with carbo-fuchsin\*.

I have now to record an interesting case of spontaneous change in some apples, which occurred under the following circumstances:—Last autumn I received from a friend in America a case of very choice Canadian apples. The case had a separate cardboard partition for every apple, and they were all in excellent condition. Some of them were kept as late as the second week in January of this year. From about the middle of December I noticed that many of these apples, when cut through the centre, showed a brown discoloration which seemed to begin at a number of separate points around the periphery of the core, as may be seen in Pl. XXVI. fig. 8, A & B ( $\frac{1}{2}$  nat. size). An early stage of the change is shown in A, and a more advanced stage in B. In all other respects the apples were perfectly sound and of a delicious flavour, and none of those eaten anterior to the date mentioned showed any unusual appearance. Towards the end of December the above photographs were taken; and, on consulting Lindley's 'Vegetable Kingdom,' it became plain, from a figure there shown (p. 559), that these points of change occurred at the junction of the ovarian and the calycine portions of the fruit.

I examined portions of the altered tissue under the microscope, fully expecting to find some Mould as the cause of the change. But, much to my surprise, after a tolerably careful examination, I was unable to feel sure that organisms of any kind were to be found in the tissue which had become thus altered. Subsequently I tried to stain some sections, and made a still more careful examination, with the result that I found on or in the primordial utricle of many cells cocci-like bodies looking like the germs of microorganisms. But as their nature seemed doubtful I took two of the apples to Dr. Allan Macfadyen and asked him kindly to see whether any microorganisms could be developed from this altered tissue of the apple. On January 5th he wrote to me as follows: "I was unable to detect the presence of Bacteria in the Canadian apples you left here, by microscopical exami-

\* As the magnification is low, the use of a pocket-lens will make these organisms more distinct, especially those near the centre of the figure.

nation. I accordingly made a number of subcultures, but in no instance have I succeeded in obtaining a growth"\*.

I had by this time only two or three of the apples left, so I placed them in the incubator at a temperature of 76° F. and there left them for eight days. On section two of them were found to present the brown discoloration in the usual situations to a well-marked extent. Some portions of the brown tissue were broken up with needles, placed in a dilute solution of the "mastzellen" stain, and were afterwards submitted to careful examination with the microscope. There was certainly a very distinct increase of the cocci-like bodies in the primordial utricle, remaining unstained, as in Pl. XXVI. fig. 8, C ( $\times 700$ ), though all the other granules in the cells had become strongly stained. In some places the cocci were seen in distinct rows, branching and crossing one another, as in fig. 8, J ( $\times 375$ ) in the neighbourhood of the letter, so that they looked like spores within minute filaments†.

A further careful and prolonged examination revealed the fact that very many of the cells showed, in whole or in part, on or in the lining membrane, the cocci-like bodies as in C, though in other cells there were none of them. There was often a tendency for these bodies to arrange themselves in rows (as in E and I), and in places to grow into delicate filaments (as in D and F). Such filaments were also seen occasionally crossing the cavity of the cell, and having spore-like bodies at intervals. A few larger filaments or hyphæ, such as G, were likewise seen, together with toruloid corpuscles, as in H. The spore-like body in G, from which the hypha has developed, is only a little larger than one of the cocci-like bodies to be seen near the lower left corner of C. Any doubts as to the reality of these latter bodies being embryo Bacteria may be set at rest by comparing them with what is shown in Pl. XXV. figs. 2 and 4. All the organisms found here, as with those shown in the figures above mentioned from other vegetable cells, were similar in refusing to stain with all ordinary dyes.

Although the first examinations of these apples showed, therefore, only very doubtful organisms or none at all, a

\* Some time previously Dr. Nabarro, of University College, had been similarly unsuccessful in obtaining growths from a potato which had been treated in the manner I have detailed on p. 390, and in which organisms seemed to be present in an early stage. Such lack of success after trials with a few culture media is, of course, far from disproving the presence of microorganisms.

† Unfortunately this particular photograph was taken at a low magnification, but C and each of the others were taken at 700 diameters.



prolonged search has made their presence abundantly clear, and has shown that the "spontaneous" changes occurring in so many distinct foci in the very midst of their tissue has been correlated with the origin and development of micro-organisms.

I have also made a very few observations on *Tangerine Oranges*, to two of which I will refer. In February, 1901, two of these oranges were placed in a screw-top bottle and soaked in a 10 per cent. solution of formalin for fifteen minutes, the fluid being also shaken about several times so as to wet the whole inner surface of the bottle. After the fluid was poured off and the cover tightly screwed on, the bottle was placed in a cupboard for fifteen days, the average temperature of which was about 50° F.

When the first of these oranges was cut through in a longitudinal direction, a slight mouldy odour was at once perceived, and in the central white tissue and around the pips there was a greenish-black mass of mould. This was strictly confined to the central parts of the orange, and nowhere came within three fourths of an inch of the surface. The skin generally was perfectly sound, though it had become hard and was of a slightly brownish colour from the action of the formalin. Microscopical examination of the more peripheral parts of the orange also showed no mycelial filaments or organisms of any kind.

The other orange in the same bottle showed no organisms either to the naked eye or on microscopical examination.

Soon afterwards two other *Tangerine* oranges were treated in the same way, and subjected to similar conditions, except that they were left in the bottle for a much longer period—that is, for five and a half weeks instead of only fifteen days. About five days before the bottle was opened, one of the oranges was seen to show a patch of dark colour on one side, and when it was subsequently cut open longitudinally all the central white tissue was found to present an altered appearance, being of a rather dirty white colour; and on microscopical examination it was found to be densely infiltrated with a delicate *Fungus* mycelium. The seeds were discoloured, and the mycelium was also found to extend into the yellow substance of the orange. In one place there was a patch of a blackish colour, and this was found to have grown into the rind of the orange at the point where the discoloration on the surface was seen. It had not, however, actually reached the external surface; it had evidently grown from

within outwards, and the surface of the orange here and elsewhere showed no trace of Mould of any kind.

The companion orange again showed no organisms, either internally or externally.

There is no means of accounting for Mould springing up in the interior of an orange by infection from without. In a memoir entitled "*Recherches sur la Pourriture des Fruits*"\*, Davaine points out that in fruits, such as the apple, the pear, and the medlar, in which there is an open calyx, "*le tube calicinal peut conduire les spores ou leurs filaments jusqu'au centre du fruit. C'est ainsi que se produit le blettissement* †, qui n'est autre chose qu'une pourriture"; but the process of rotting, he says, *is always external* "*chez les fruits qui sont partout recouverts d'un épiderme, tels que le citron, l'orange, et les fruits à noyau.*"

In the case of the apples to which I have referred, there was clearly no such process of infection from within as that to which Davaine refers. In the Canadian apples the change occurred simultaneously in many points almost as much removed from the seed-cavities as from the surface of the apples, and a comparison of what was found in the primordial utricle of the cells with what has been found in similar situations in the potatoes that have been referred to, leaves little room for doubt that what are shown in Pl. XXVI. fig. 8, C, D, are really germs of microorganisms; while in the other apple delicate Fungus mycelia (fig. 7, A) were found springing up within various isolated cells in the midst of the substance of the fruit. Again, the presence of the Bacteria and other organisms within the cells of the two small turnips and the different potatoes that have been referred to are equally incapable of being accounted for by any process of infection from without. There is absolutely no relation between what I have found in these cases and an actual process of infection such as M. C. Potter has described (see p. 385). We have to do, in fact, in the cases that I have cited, with motionless germs of microorganisms arising *de novo* in or on the substance of the primordial utricle of isolated cells, having intact walls, and scattered throughout the substance of the potatoes and the turnips in question—in all parts, that is, except in the superficial

\* Compt. Rend. 1866, pp. 277-344.

† That is, the mellowing process that occurs in pears and medlars more especially. Further on in his paper Davaine says he has "recently recognized that this latter process (blettissement) may take place where spores are excluded, and in the absence of any mycelium."

portions that have been saturated with the germicidal fluid in which they had been for a time soaked\*.

As I have previously pointed out, the existence of "latent germs" in the substance of healthy fruits and vegetables is not assumed—it is, in fact, expressly denied (pp. 383, 390). Hence the great weight to be attached to the preceding observations as evidence that the various microorganisms found within the cells have actually originated there by heterogenesis.

It remains to be seen what evidence of similar cogency can be obtained in regard to the origin of microorganisms within the tissues of animal organisms.

It would be useless to multiply instances. I will therefore first cite a single case in which the origin of Bacteria may be actually watched within the body of a low animal organism, and then turn to their mode of appearance within some of the tissue elements of different vertebrates.

Evidence of a particularly convincing nature is to be obtained from the examination of a little creature low in the scale of animal life, namely, *Cyclops quadricornis*, one of the Entomostraca so commonly to be found in ponds. It may be seen from pl. xxiv. of Baird's 'Natural History of the British Entomostraca'† that the four pairs of abdominal feet and also the tail are furnished with a number of "plumose spines or setæ."

Examination of one of these organisms will show that within the chitinous envelope of these slender spines, which taper away to sharp points, there is nothing but structureless protoplasm to be seen (Pl. XXVI. fig. 9, A,  $\times 700$ ). If we take one of these little creatures, put it in a drop of distilled water on a glass slip, with a tiny fragment of a No. 2 cover-glass on each side of it, and place over all a cover-glass, it will be found that the animal is soon killed by the weight of the latter, though the fragments of glass prevent rupture of the body. We may then place the microscope-slip in a Petri dish containing a thin stratum of water (so as to prevent evaporation from beneath the cover-glass), and fixing upon one of the tail-setæ, which are larger than those on the abdominal feet, we may examine it from time to time. What may be observed is this:—

After an interval of two or three days (the duration depending upon the temperature of the air at the time), we

\* In these cases the organisms often have to be long and carefully searched for. A perfunctory examination would almost certainly lead to the statement that no organisms were present.

† Ray Society, 1850.

may see, under the highest power of our microscope, scarcely visible motionless specks gradually appear in increasing numbers in the midst of the structureless protoplasm; and still later we may see some of these specks growing into Bacteria, as in Pl. XXVI. fig. 9, B,  $\times 700$ , which is a representation of A after four days. At last the whole interior of the spine becomes filled with distinct Bacteria, as may be seen in C ( $\times 700$ ), which is from a photograph of the same spine on the sixth day—the temperature during these days varying from  $70^{\circ}$ – $75^{\circ}$  F. Later still, all the Bacteria, previously motionless, began to show active swarming movements.

In such a case it is clear that we have to do with no process of infection from without, but with a *de novo* origin of Bacteria from the protoplasmic contents of the spines or setæ. The fact that they appear in these situations as mere separate motionless specks, and gradually take on the forms of Bacteria (also motionless at first), is, as I have previously indicated, just what we might expect if they had actually taken origin in the places where they appear. On the other hand, such a mode of appearance is totally opposed to what might be expected if the microorganisms had obtained an entry from without, through the chitinous envelope of the spines.

I pass now to what may be regarded as another absolute proof of the heterogenetic origin of Bacteria, as convincing as that which I have shown to occur within the closed cells of certain vegetables.

I have already pointed out that in many parts of the bodies of man and of higher animals microorganisms are known to exist in abundance. This is the case, for instance, throughout the whole length of the alimentary tract, and throughout almost the whole extent of the mucous membranes of the respiratory tract. It is clear also that some of the microorganisms may be taken up from these mucous membranes by lymphatics, and if they pass the nearest lymphatic glands some of them would ultimately find their way into the blood. When there, the view generally accepted is that the Bacteria and their allies are at once “destroyed.” The blood of healthy animals is declared to be germless, and much importance is attached to the germicidal qualities of this fluid.

On the other hand, it has been found, as I have previously intimated (p. 384), that in organs contiguous to the alimentary canal—such as the kidney, the pancreas, the spleen, and the liver—taken from a healthy animal immediately after



death, with every precaution needful to prevent contamination from without, swarms of microorganisms can be made to appear therein at will.

Speaking of such experiments made by himself, Burdon Sanderson wrote as follows\*:—"Under the conditions I have described to you, it seems to me quite impossible to suppose either that germs could penetrate to the organ from the outside or that any germ encountered by the organ in its transference from the body of the animal to the basin could escape destruction. If, therefore, Bacteria be found, they or their germs must have been there before the organ was plunged into the hot liquid. . . . The results of all the experiments, whether with liver or kidneys, was the same. The soft red kernel of uncooked tissue at the middle of the organ always contained Bacteria, the vigorous development of which was indicated by their large size, countless numbers, and active movements. To my mind the experiment is conclusive."

In reference to this it is right to say that similar results have been obtained by other investigators using either similar methods or methods equally trustworthy. Such experiments have been made by Tiegel, Billroth, Nencki and Giacosa, Horsley and Mott, as well as by myself.

As I have previously intimated, the finding of organisms under these conditions is a fact so important in view of the theories of Pasteur and Lister, and the general belief as to the germicidal qualities of the blood, that the results require to be most carefully scrutinized.

To postulate the presence of "latent germs" in these abdominal organs and to assign as a reason the close "proximity to absorbing mucous membranes," and nothing else, surely cannot be regarded as a full and satisfactory explanation. It assumes, without proof of any kind, that microorganisms, even in healthy animals, are constantly making their way out through the walls of the intestine, and wandering promiscuously into this or that organ, only in the end to lapse into a condition of "latent vitality." Could anything in the way of explanation be more gratuitous and unsatisfactory?

With a view to throwing light upon this important question by the production of actual evidence I obtained a sheep's kidney from a recently killed animal, and saw a coating of fat nearly an inch thick stripped from it. The whole organ was then left to soak for four hours in a two per cent.

\* Brit. Med. Journ. 1878, vol. i. p. 119.

solution of chromic acid, when it was removed and placed in a bottle still wet with a 10 per cent. solution of formalin. The screw-top having been fixed so as to prevent evaporation, the bottle was transferred to an incubator and left at a temperature of 76° F. for thirty-six hours \*. When the organ was cut the chromic acid was found to have discoloured it to a depth of about a quarter of an inch, but within that margin the kidney-substance was red and only slightly softer than natural. There was no distinct odour of putrefaction. A small portion of the organ was cut out and teased in a drop of a weak solution of gentian-violet, and fragments, after a short interval, were carefully examined under the microscope. A comparatively small number of Bacteria were found free, between the separated and broken up cells, and the cells were densely filled with granular matter, as may be seen in Pl. XXVI. fig. 10, A ( $\times 700$ ), but it was impossible to identify with certainty any of the granules as germs of Bacteria. Sections that were made and carefully stained gave no more definite results.

Another sheep's kidney from a freshly killed animal was therefore obtained and treated in the same manner, except that it was left in the incubator at 76° F. for three and a half days. When the organ was cut through it was deeply stained at the circumference as before with the chromic acid; but the red tissue within was much softer, and the odour was most offensive and putrid. Portions of the organ were at once put into a 10 per cent. formalin solution with a view to obtaining sections therefrom, but a minute portion was cut off as before and teased in a drop of gentian-violet. On examination with the microscope after a brief interval I found the fragments of the tubules and kidney-cells full of Micrococci which had taken the stain well, together with numbers of figure-of-eight organisms and short chains (Streptococci) such as are shown in Pl. XXVI. fig. 10, B ( $\times 700$ ).

In a few days Dr. J. S. Collier kindly sent me a number of sections, stained and unstained, which he had been good enough to cut from the portion of the kidney in the formalin solution which I had handed over to him. Some of the specimens sent to me had been stained with methylene-blue or with logwood, and then mounted in balsam; while I stained some of the plain sections with gentian-violet, and subsequently mounted them in glycerine. On the whole, rather more details could be made out with these latter sections than with the specimens mounted in balsam.

\* I was using the incubator for other purposes at this temperature, and therefore did not alter it.

Every section, however, showed, inside the area which had been affected by the chromic acid, that almost every cell within the renal tubules was full of developing or actually developed Bacteria. The former appeared as mere cocci-like particles which had taken the stain like the developed Bacteria, both being situated in the midst of cell-granules comparatively unstained. The organisms were distributed through the substance of the cells, but often seemed to be most abundant in the half of the cell next the wall of the tubule, as may be seen in the transverse and longitudinal sections of tubules shown in Pl. XXVI. fig. 11, A, B ( $\times 700$ ). In a few of the tubules in the pyramidal portions of the kidney the organisms had developed more abundantly, so that the cells were filled with a dense mass of Micrococci such as may be seen in fig. 12, A ( $\times 700$ ). In sections through blood-vessels also a moderate number of Bacteria were seen mixed with the blood-corpuscles.

Here, then, it is clear that we have again the kind of appearances which we have a right to expect if the micro-organisms had developed in the epithelial cells of the kidney by heterogenesis. We have the cells full of particles developing into fully formed Bacteria, and, what is more important still, we have them within almost every epithelial cell to be seen in the sections.

From the point of view of the really absurd suggestion as to organisms being found in such an abdominal organ as the kidney, by reason of its "proximity to absorbing mucous membranes," it may be well to recall the fact that the sheep's kidney is encased in a mass of fat from half an inch to an inch in thickness, and that, as an additional barrier separating wandering microorganisms from the epithelial cells of the organ, there is still the thick and tough capsule which I have thought it not useless to show in fig. 12, B ( $\times 700$ ). Let anyone compare M. C. Potter's description (p. 385) of the mode in which Bacteria are enabled to effect an entry into a single vegetable cell, and then let him imagine what an army of Bacteria would be needful, with all the cytase that they could excrete, to get through such a tough and thick layer as that presented by the fibrous capsule of the kidney. But surely the whole notion as to such a mode of infection of the kidney and other abdominal organs is too absurd for serious consideration.

We are then driven back to enquire whether it is true that the blood is germless, and whether it has in reality the bactericidal qualities with which it is credited. I have no evidence whatever to oppose to these beliefs, nor is it easy

to see, even if bacteriologists generally should be wrong in their views as to these points, how it would suffice to explain the development of Bacteria within all the cells of a kidney treated in the way I have mentioned.

It is perfectly certain that the blood of healthy persons does not contain any appreciable number of active Bacteria. But are bacteriologists right in supposing that such Bacteria as get into the blood-stream are "destroyed"? May they not rather be reduced to a condition of latent vitality? Their answer to this is that, if it were true, the organisms would be capable of revealing their presence when suitable media were inoculated with them and subsequently exposed to proper incubating temperatures. And it is the negative results of all such experiments with the blood of healthy animals that confirm them in their belief as to the germicidal qualities of the blood.

Nor, in fact, if the blood were assumed to be full of latent germs of Bacteria, would it be easy, as I have intimated, to see how that would enable us to explain the development of Bacteria within almost every epithelial cell in the kidney referred to. Could organisms reduced to a condition of "latent vitality" penetrate the walls of the capillaries, and thence migrate into all the cells of a kidney-tubule? The notion is again too preposterous to be entertained; so that we are compelled by evidence of a most convincing character to admit that the Bacteria have in reality been born in the individual cells of the kidney—we are compelled to believe that heterogenesis has, in fact, been taking place here as in the other instances previously cited.

## EXPLANATION OF THE PLATES.

### PLATE XXV.

- Fig. 1.* Development of Bacteria between the cell-wall and the chlorophyll layer in a living *Nitella* cell.  $\times 700$ .
- Fig. 2.* A. Early stages of Bacteria developing in primordial utricle of Potato cell.  $\times 700$ .  
 B. Early stages and developed Bacteria within a neighbouring cell.  $\times 500$ .
- Fig. 3.* A. Bacilli and Mycelia filaments within a cell of another Potato.  $\times 500$ .  
 B. Interlacing spore-bearing Bacilli in or on the primordial utricle of another cell from the same Potato.  $\times 500$ .
- Fig. 4.* A. Microorganisms developing in or on the primordial utricle of a small new Potato.  $\times 500$ .  
 B. More developed form of similar *Crenothrix*-like filaments in another cell of the same Potato.  $\times 500$ .



*Fig. 5.* Tufts of a form of *Cladothrix* growing from the primordial utricle in the cell of another new Potato.  $\times 500$ .

*Fig. 6. A.* A large aggregation of Bacteria together with other scattered specimens within a cell of a small Turnip.  $\times 500$ .

*B.* Numbers of Bacteria developing in and on the surface of the primordial utricle in a cell from another Turnip.  $\times 500$ .

PLATE XXVI.

*Fig. 7. A.* Minute Fungus mycelium within the cell of an Apple.  $\times 250$ .

*B.* Micrococci or Bacteria developing in or on the primordial utricle in another cell of the same Apple.  $\times 375$ .

*Fig. 8. A and B.* Early and later stages of change in a Canadian Apple.  $\frac{1}{2}$  nat. size.

*C and E.* Micrococci-like bodies developing in or on the primordial utricle in cells of one of these Apples.

*D and F.* Similar bodies in other cells giving rise to thread-like growths, after the fashion shown more plainly in fig. 4, A.

*G.* Larger body of the same kind from which a small hypha is developing.

*H.* A group of small *Torula* cells.

*J.* Minute branching and interlacing filaments containing rows of spores or cocci-like bodies in or on the primordial utricle of another cell.

*C, D, E, F, G, H,* each  $\times 700$ ; *J,*  $\times 375$ .

*Fig. 9. A.* Caudal plumose spines of a recently dead *Cyclops quadricornis* showing homogeneous protoplasm within.

*B.* One of the same spines after four days showing motionless Bacteria developing within the protoplasm.

*C.* The same spine after two more days showing motionless Bacteria much increased both in size and in number.

Each  $\times 700$ .

*Fig. 10. A.* Granules and nuclei from disintegrated cells of a sheep's kidney after exposure to conditions described in text for thirty-six hours.

*B.* Disintegrated portions of cells from another sheep's kidney which had been exposed to similar conditions for three and a half days—now swarming with Micrococci and Streptococci.

Both specimens had been teased in a weak solution of gentian-violet, and both were  $\times 700$ .

*Fig. 11. A and B.* Transverse and longitudinal stained sections of tubules from the same kidney, showing the cells crowded with Micrococci and Streptococci.

Each  $\times 700$ .

*Fig. 12. A.* Dense masses of Micrococci in pyramidal portion of same kidney.

*B.* Stained portion of the same kidney, showing the thickness of its capsule as seen under the same magnification.

Each  $\times 700$ .

XXXIX.—*Notes on the Natural History of East Finmark.*

By Canon A. M. NORMAN, M.A., D.C.L., LL.D., F.R.S.,  
F.L.S.

[Continued from p. 286.]

[Plate XXVII.]

## ECHINODERMATA.

IN East Finmark the Echinodermata are very fully represented; but the percentage of species found by myself in this class is much less than in those classes with which I have already dealt. The reason is obvious. I did not employ the instruments most suitable for their capture, namely, either a trawl or wide-meshed dredge. As usual, I was more intent on the smaller and generally less studied animals, and my fine dredge-bag, quickly filling with mud, passed over comparatively little ground; and therefore the capture of many of the larger animals, such as Echinodermata, was not to be expected.

I propose in dealing with the Echinodermata to depart from the rule which I have observed in previous parts of these notes of only giving the names of East Finmark species which had not been found by myself, and to briefly indicate their locality and its authority. The authorities on whom I have relied are as follows:—

1. DANIELSSEN (D. C.).—"Beretning om en zoologisk Reise foretagen en Sommeren 1857," *Nyt Mag. for Naturvidenskaberne*, vol. xi. 1861, p. 1.
2. SÆRS (MICHAEL).—"Oversigt af Norges Echinodermter," 1861.
3. DANIELSSEN (D. C.) and KOREN (A.).—(a) *Holothuroidea*, (b) *As-teroidea*, (c) *Echinoidea*, in 'The Norwegian North-Atlantic Expedition, 1876-1878,' 1882, 1884, and 1892.
4. GRIEG (J. A.).—*Ophiuroidea* in 'The Norwegian North-Atlantic Expedition, 1876-1878,' 1893. The word 'Vöringen' in the following notes, which was the name of the vessel employed, indicates that the authority is in the Norwegian North-Atlantic Expedition Reports.
5. GRIEG (J. A.).—"Oversigt over det nordlige Norges Echinodermter," *Bergens Museum Aarbog*, 1902.
6. ÖSTERGREN (HJALMAR).—"The *Holothuroidea* of Northern Norway," *Bergens Museum Aarbog* (1902), 1903, p. 3.

A full account of the distribution of the species and full synonymy will be found in the treatises on the different orders in Römer and Schaudin's '*Fauna Arctica*.'

OPHIUROIDEA.

- Ophiura Sarsii*, Lütken. In all the Sydvaranger fiords.  
 — *albida*, Forbes. Vadsö (*Danielssen*).  
 — *robusta*, Ayres. Varanger, Bög, and Lakse Fiords. Also Svolveær, Lofoten Islands, shallow water to 125 fathoms.  
 — *carnea*, M. Sars. Vadsö, in 50–100 fathoms (*M. Sars*).  
 — *affinis*, Lütken. Unusually large in the Varanger Fiord; also at Svolveær, Lofoten Islands.  
*Ophiocten sericeum*, Forbes. Off Vardö, in 148 fathoms ('Vöringen,' Stat. 262).  
 \* *Amphiura elegans*, Leach. I found this species at Svolveær, Lofoten Islands. It is not yet known in East Finmark, though it has been recorded from as far east as the Murman coast by Jarzynsky.  
*Ophiopholis aculeata*, Linné. In all the fiords.  
*Ophiacantha bidentata*, Retzius. Varanger and Lang Fiords, down to 125 fathoms (*A. M. N.*); Porsanger Fiord (*Grieg*).  
*Ophiocolex glacialis*, Müller & Troschel. Off Vardö, in 148 fathoms, four small specimens ('Vöringen,' Stat. 262).  
 — *purpureus*, Düben & Koren. Dr. Hjort, in the 'Michael Sars,' dredged this species in 1900 in the Porsanger Fiord (*Grieg*).  
 [*Asteronyx Lovéni*, Müller & Troschel. Herr Grieg informs me (*in litt.*) that this species was inserted by mistake in the East Finmark column of his paper. It was taken by M. Sars in Öxfjord, West Finmark, and not in Oxfjord in East Finmark.]  
*Gorgonocephalus Lamarchi*, Müller & Troschel. Herr Grieg writes to me that a specimen of this species from Varanger Fiord (Vadsö) is in the Bergen Museum.  
 — *eucnemis*, Müller & Troschel. Taken by M. Sars at Vadsö in 1857 on *Primnoa lepadifera*; but some doubt attaches to the identification of the young specimen (*Sars*, 2).  
 — *Agassizii*, Stimpson. This species is in the Bergen Museum from the Varanger Fiord (*Grieg*). This is the only instance of its occurring on the European coast. It is known from N.E. America, Greenland; and Jan Mayen.

ASTEROIDEA.

- Archaster tenuispinus*, Düben & Koren. Porsanger Fiord and off Vardö, in 127–148 fathoms ('Vöringen').  
*Plutonaster Parelii*, Düben & Koren, var. *longibrachialis*, Dan. & Kor. In the same two dredgings as the preceding ('Vöringen').  
*Ctenodiscus crispatus*, Retzius. Inner reach of Lang Fiord, in 5–30 fathoms; Bög Fiord, in 100–120 fathoms; and Varanger Fiord, 100–125 fathoms.

*Leptophycaster arcticus*, M. Sars. Tana Fiord and off Vardö, in 127–148 fathoms ('Vöringen').

*Psilaster andromeda*, Müller & Troschel. Danielssen and Koren write of this species, "along the entire Norwegian coast," and Grieg has inserted it in the East Finmark column on this authority; but though I have searched carefully I have been unable to find any actual statement of its occurrence there. It may certainly be expected, as Jarzynsky has found it on the Murman coast.

*Pentagonaster granularis*, Retzius. Sværholt, by the 'Michael Sars,' 1901; Tana Fiord and off Vardö ('Vöringen').

*Goniaster phrygianus*, Parelius. Porsanger Fiord and off Vardö ('Vöringen'); Sværholt (Grieg).

*Poraniomorpha rosea*, Danielssen & Koren. Dredged by Herr Hjort in the 'Michael Sars' in 1901, S.S.W. of Kibergnæsset in the Varanger Fiord, in 188–216 metres (Grieg).

*Hexaster obscurus*, Perrier. Dredged by the 'Michael Sars' in 1901 east of Ekero in the Varanger Fiord, in 180–216 metres (Grieg).

*Pteraster militaris*, O. F. Müller. Vadsö (Danielssen); Sværholt (Grieg).

— *pulvillus*, M. Sars. Lang Fiord, in 25 fathoms (A. M. N.); Sværholt (Grieg).

*Crossaster papposus*, Fabricius. In Lang and Klosterelv Fiords.

— *affinis*, Brandt. One small specimen of this ten-armed *Crossaster* was dredged by the 'Vöringen' off Vardö (Stat. 262). It is a question whether it is really distinct from *C. papposus*, with which Ludvig unites it; but, on the other hand, Danielssen and Koren write that after careful examination of exterior features and internal skeleton they have "arrived at the conclusion that the difference between *Solaster affinis* and *Solaster papposus* is so great and also so constant that we must still affirm the former to be a distinct species."

*Solaster endeca*, Gmelin. Herr Grieg writes to me that Dr. Johan Hjort has collected this species in Kongs Fiord. This small fiord will not be found marked on ordinary maps; it is situated in long. 47° 20' E.

— *syrtensis*, Verrill. Dredged by the 'Michael Sars' in 1901 to the east of Ekero in the Varanger Fiord, in 188 metres (Grieg). I do not know this eight- or nine-armed form. Ludvig, in 'Fauna Arctica Seesterne,' 1900, unites it with *S. endeca*.

*Cribrella sanguinolenta*, O. F. Müller. In Lang and Klosterelv Fiords,

[*Pedicellaster typicus*, M. Sars. Herr Grieg informs me that he inserted this species in his East Finmark column because it



was dredged by the 'Vöringen' in Barents Sea (*i. e.* Stat. 267, lat.  $71^{\circ} 42' N.$ , long.  $37^{\circ} 1' W.$ , in 148 fathoms\*.)]

*Asterias rubens*, Linné. Varanger Fiord.

— Müller, M. Sars. Vadsö (*Danielssen*); Sværholt (*Grieg*).

[? — *glacialis*, Linné. Grieg marks this in his East Finmark column, but gives no locality, and, indeed, states that it is found up the whole coast to Komag Fiord; but that fiord is in West Finmark.]

### *Asterias Linckii*, Müller & Troschel.

1733. *Pentadactylosaster reticulatus digitis praelongatis*, Linck, De Stellis Marinis, p. 34, pls. ix. & x. no. 16.

1842. *Asterias Linckii*, Müller & Troschel, System der Asteriden, p. 18.

1869. *Asteracanthion stellionura*, Perrier, Recherches sur les Pédicellaires et les Ambulacres des Astéries et des Oursins, p. 48, pl. i. figs. 10 a-d.

1882. *Asterias Gunneri*, Danielssen & Koren, "Fra den norske Nordhavsexpedition," Nyt Mag. for Naturvid. vol. xxvii. p. 268.

1884. *Asterias Gunneri*, Dan. & Kor. Norw. North Atlant. Exped., Asteroidea, p. 7, pls. ii., iii. figs. 8, 9.

1884. *Asterias stellionura*, *ibid.* *ibid.* p. 14, pl. iv. figs. 1-9.

1887. *Asterias stellionura*, Levinsen, Dijnphna-Togtets zool.-botan. Udbytte, p. 395, pl. xxxiv. figs. 7, 8, a, b.

Levinson's figures and description should be consulted when determining this species. His fig. 7 illustrates the adambulacral papillæ &c., and shows the absence of those adambulacral spines to which I shall call attention in my notice of the next species.

The type of "*A. Gunneri*" was taken by the 'Vöringen' in Advent Bay, Spitsbergen, while "*A. stellionura*" was taken by the same expedition not only a little to the south of Spitsbergen, but also off Vardö in 148 fathoms (Stat. 262). Lovén has also recorded it from the Varanger Fiord, and more recently it has been again dredged by the 'Michael Sars' in 180 metres off Ekero, at the mouth of the same fiord.

### *Asterias panopla*, Stuxberg.

1878. *Asterias panopla*, Stuxberg, "Echinod. Nordenskiöldska Exped. 1875-76," Öfvers. K. Vet.-Akad. Förhand. xxxv. p. 32.

1881. *Asterias panopla*, F. Jeffrey Bell, "Species of the Genus *Asterias*," Proc. Zool. Soc. p. 505.

1884. *Asterias panopla*, Dan. & Kor. Norweg. North Atlant. Exped., Asteroidea, p. 17, pl. v.

1887. *Asterias panopla*, Levinsen, Dijnphna-Togtets zool.-bot. Udbytte, p. 394.

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\* I have not in these papers taken into account the 'Vöringen' stations 267, 270, 273, and 275, which were to the north of East Finmark. If this were done, other species would be added to the fauna.

I dredged this species on two occasions in quite shallow water, in 5–30 fathoms, in the inner part of Lang Fiord. It is new to the Norwegian fauna. The size of one of these specimens is nearly double that represented in Danielssen and Koren's plate, and the single row of spines passing down the centre of the back of each arm is very conspicuous, as in the figure referred to. On the other hand, in much smaller specimens collected in the Kara Sea by the 'Dijmphna' expedition, for which I am indebted to the Copenhagen Museum, this central row of spines is scarcely noticeable. The character which at once distinguishes *A. panopla* from *A. Linckii* consists in the spines on the under surface of the arms, where bordering the ambulacra is seen a row of slender spines which are in pairs, and exterior to these another row of well-developed and conspicuous spines (see Dan. & Kor. pl. v. fig. 2, at the base of the left-hand side of the arm). The following quotation from Levinsen well describes the adambulacral papillæ and spines, outside of which is the other row of spines to which I have just referred:—"Papillæ adambulacrales biseriales appositæ, inter papillas singulas seriei interioris jam pedicellariæ, jam spinæ, vestigia transformationis in pedicellarias sæpe exhibentes, sitæ. Spinæ extra papillas adambulacrales per paria dispositæ, spinis singulorum parium ad basin concurrentibus, supra divergentibus."

#### ECHINOIDEA.

*Echinus norvegicus*, Düben & Koren. Rather small specimens were taken by the 'Vöringen' off Vardö (Stat. 262).

— *esulentus*, Linné. Herr Grieg writes to me that this species has recently been taken by Dr. Johan Hjort in the Varanger Fiord to the south of Kiberg.

*Strongylocentrotus dröbachiensis*, O. F. Müller. Varanger, Lang, and Klosterelv Fiords.

— *pictus*, Norman. Varanger Fiord, 100–125 fathoms; Klosterelv and Lang Fiords, in 3–30 fathoms. This form—whether species or variety—is characterized among points already described by the very large size of the "sphérides" (Lovén). Professor Lovén showed me the same form under another name in the Stockholm Museum. Unfortunately I did not make a note at the time, and have forgotten what that name was.

*Schizaster fragilis*, Düben & Koren. Taken in mid-channel in the Varanger Fiord in 100–125 fathoms. A specimen measured 75 millim. long, 65 millim. broad, and 40 millim. deep.

*Spatangus purpureus*, O. F. Müller. Sværholt (Grieg).

*Echinocardium fluvescens*, O. F. Müller. Vadsö (M. Sars); Sværholt (Grieg).

— *cordatum*, Pennant. Sværholt (Grieg)\*.

*Echinocyamus pusillus*, O. F. Müller. Vadsö and Bög Fiord.

## HOLOTHUROIDEA.

### Genus STICHOPUS, Brandt.

*Stichopus tremulus* (Gunnerus).

"In the Christiania Museum there is a specimen which G. O. Sars caught in the Varanger Fiord" (Nordgaard, 1903).

### Genus CUCUMARIA, Jæger.

*Cucumaria frondosa* (Gunnerus).

I procured young specimens (= *C. fucicola*, Forbes) between tide-marks at Vadsö.

### Genus PHYLLOPHORUS, Grube.

*Phyllophorus pellucidus* (Fleming).

Michael Sars recorded that he had taken two specimens of this species in the Varanger Fiord near Vadsö, in 60-80 fathoms, in 1857.

### Genus PSOLUS, Oken.

*Psolus phantapus* (Strussenfeldt).

Bög and Lang Fiords, in 5-30 fathoms (A. M. N.). Michael took it in the Varanger Fiord in 1857.

### Genus TROCHOSTOMA, Danielssen & Koren.

*Trochostoma boreale* (M. Sars).

1861. *Molpadia borealis*, M. Sars, Oversigt af Norges Echinodermer, p. 116, pls. xii., xiii.

1877. *Haplodactyla arctica*, v. Marenzeller, "Coelenteraten, Echinodermen und Würmer der k. k. öster.-ungar. Nordpol-Exped.," Denkschr. math.-nat. Klasse kais. Akad. d. Wiss. Zool. vol. xxxv. p. 29, pl. iv. fig. 1.

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\* I have inserted this species and *Spatangus purpureus* in this list because Grieg (5) gives the locality Sværholt; yet he does not mark them in his East Finmark column at p. 37. Was that an accidental omission, or are there two places named Sværholt?

1882. *Trochostoma Thomsonii*, Danielssen & Koren, Norwegian North-Atlantic Exped., Holothuroidea, p. 42, pls. vii., viii., ix. figs. 38-41, pl. xiii. fig. 4, and var. *maculatum*, p. 94, pl. xiii. figs. 5, 6.  
 1882. *Trochostoma boreale*, iid. ibid. p. 64, pl. x. figs. 7-11.  
 1882. *Trochostoma arcticum*, iid. ibid. p. 65, pl. ix. figs. 1-5, pl. x. fig. 6, pl. xiii. fig. 3.

Ludvig, in 'Fauna Arctica,' vol. i. Holothuroidea, p. 161, unites all the forms described by Danielssen and Koren under the *Molpadia borealis*, M. Sars.

The form called *Trochostoma arcticum* by Danielssen and Koren was dredged by the 'Vöringen' in the Porsanger Fiord in 127 fathoms (Stat. 260), and in the same depths in the Tana Fiord (Stat. 261).

### Genus ANKYRODERMA, Danielssen & Koren.

#### *Ankyroderma Jeffreysii*, Danielssen & Koren.

1879. *Ankyroderma Jeffreysii*, Danielssen & Koren, "Fra den Norske Nordhavsexpedition Echinodermer, III.," Nyt Mag. for Naturvid. vol. xxv. p. 128, pls. v. & vi. figs. 11-19, 21.  
 1879. *Ankyroderma affine*, iid. ibid. p. 133, pls. v. & vi. figs. 22-28.  
 1882. *Ankyroderma Jeffreysii*, Dan. & Kor. Norw. N.-Atlant. Exped., Holothuroidea, p. 67, pls. x., xi., xii. figs. 12-28.  
 1882. *Ankyroderma affine*, iid. ibid. p. 71, pl. xii. figs. 29-36.

Ludvig (*l. c.*) has united the two forms to which the describers had assigned specific rank.

This most interesting new form discovered by the 'Vöringen' was dredged at Stations 260, 261, 262, at the Porsanger and Tana Fiords, and also off Vardö in 127-148 fathoms. It possesses anchors like those of a *Synapta*, but instead of resting for support upon a single calcareous plate, as in that genus, they are attached at the central junction of the "heads" of five or six "battledore"-shaped spicules, the long "handles" of which spicules radiate from the centre. Other spicules not unlike those of a *Thyonidium* are profusely scattered throughout the epidermis.

The *Ankyroderma musculus* (Risso) from the Mediterranean comes very near to this species (*vide* Ludvig, Zeits. f. wiss. Zool. vol. li. p. 571, pl. xxix.).

### Genus EUPYRGUS, Lütken.

#### *Eupyrgus scaber*, Lütken. (Pl. XXVII. figs. 1-3.)

1857. *Eupyrgus scaber*, Lütken, Oversigt over Grönlands Echinodermata, p. 22.  
 ? 1857. *Eupyrgus scaber*, Barrett, "Description of Four new Species of



Echinodermata," Ann. & Mag. Nat. Hist. ser. 2, vol. xx. p. 46, pl. iv. figs. 2 a, b.

1868. *Echinosome hispidum*, Semper, Reisen in Archipel der Philippinen, vol. ii. Holothurien, p. 44, pl. x. figs. 7, 10, 11, 13, 15, 16.

1868. *Eupyrus scaber*, iid. ibid. p. 268.

1886. *Eupyrus scaber*, Theel, Report 'Challenger' Exped., Holothuroidea, pt. 2, p. 49.

I dredged this species, which is new to the Norwegian coast, in the Varanger Fiord, in 125–150 fathoms, and also in Bög Fiord in 100–120 fathoms. It had been obtained by the 'Vöringen' in the sea to the north of East Finmark (Stat. 267), and has a distribution ranging from Labrador and Greenland to Spitsbergen and Barents and Kara Seas.

The calcareous deposits in the test of *Eupyrus scaber* have not been well figured, and I therefore now illustrate them. It is true that Barrett\* figured two deposits which he referred to this species; but if they belonged to it at all, they were certainly abnormal. I have been unable to find any such irregular forms either in a type specimen from Greenland received from Dr. Lütken soon after he described the species or in these East Finmark specimens which I have now taken.

These calcareous deposits (fig. 2) consist of tables which are round or nearly so, with irregular margin, perforated with about twenty to twenty-five openings with simple margins, the openings around the base of the spine being larger than those outside them, and generally oval in form, while the smaller outer holes are round; the spire is very long (fig. 3), longer than the diameter of the table from the centre of which it rises; it gradually tapers to a point which is rough or slightly spinous at the point; it is built up of three rods, which are united to each other by about four cross-bars. The surface of the test is densely clothed with these tables which are situated in it, while the spires are projected freely from the test (fig. 1). The genus *Eupyrus* being entirely devoid of feet, it is not improbable that these spires of the calcareous plates may in some degree supply a help to locomotion through the mud, aided by the muscular movements of the animal's body; but no doubt they are primarily a means of defence, as well as serve the purpose of strengthening the cutis.

\* The Holothurian which Barrett described as *Eupyrus hispidus* is, of course, no *Eupyrus*, but must be called *Echinocucumis hispidus* (Barrett), = *Echinocucumis typicus*, M. Sars; but *Echinosome hispidum* of Semper is the present species.

## Genus SYNAPTA, Eschscholtz.

*Synapta Buski*, M'Intosh.

1864. *Synapta tenera*, Norman, Brit. Assoc. Rep. for 1863, p. 106.  
 1866. *Synapta Buski*, M'Intosh, Proc. Roy. Soc. Edinb. p. 611, woodcut 6.  
 1871. *Synapta tenera*, Brady & Robertson, Proc. Zool. Soc. p. 690, pl. lxxi. figs. 1-3.  
 1892. *Synapta Buski*, F. Jeffrey Bell, Cat. Brit. Echin. Brit. Mus. p. 34, pl. i. fig. 3 (wrongly numbered in letterpress and on plate, fig. 2).  
 1898. *Labidoplax Buski*, Östergren, "Das System den Synaptiden," Öfvers. K. Vet.-Akad. Förhand. p. 115.

Östergren, in his paper on "The Holothuroidea of Northern Norway" (Bergens Museum Aarbog (1892) 1893, p. 12), tells us that "The specimens of *Synapta inhærens* which Danielssen and Koren (1882) mention from the Porsanger Fiord, long. 70° 54' N., have proved on my examination to be *Labidoplax Buski*," and also the specimens which Danielssen (1861) recorded under the same name from Vadsö.

## Genus CHIRODOTA, Eschscholtz.

*Chirodota lævis*, Fabricius. (Pl. XXVII. fig. 4.)

1780. *Holothuria lævis*, Fabricius, Fauna Groenlandica, p. 353.  
 1806. *Holothuria pellucida*, Vahl, in Müller, Zool. Dan. iv. p. 17, pl. cxxv. fig. 1.  
 1857. *Chirodota læve*, Lütken, Oversigt over Grönlands Echinodermata, p. 16, figs. 2-4.  
 1861. *Chirodota pellucida*, M. Sars, Oversigt af Norges Echinodermter, p. 124, pls. xiv.-xvi.  
 1867. *Chirodota typica*, Selenka, "Beit. z. Anat. und System. der Holothurien," Zeits. f. wiss. Zool. vol. xvii. p. 366, pl. xx. figs. 126, 127.  
 1867. *Chirodota tigellum*, id. ibid. p. 366.  
 1881. *Chirodota lævis*, Duncan & Sladen, Memoir on the Echinodermata of the Arctic Sea to the West of Greenland, p. 12, pl. i. figs. 14-19.

Dredged in the Varanger Fiord in 125-150 fathoms; and also in Lang Fiord, within the narrows, in 5-30 fathoms.

Its range extends from N.E. America and Labrador coast, Greenland, and Spitsbergen, to the Murman coast and Kara Sea.

The illustrations in M. Sars's work of this species are extremely good; nevertheless, if the wheel-deposits as figured by him be compared with the figure given by Duncan and Sladen, I think it will be conceded that, if corresponding wheels were found in a fossil state, or had such apparently

different spicules been procured from different parts of the world, it would be believed that they belonged to different species. The fact is that the figures of Sars do not represent the fully adult wheel, while that figured by Duncan and Sladen is quite mature. In the latter condition the calcareous deposit is much more developed, the central and narrow portions of the spokes have the greatest thickness, and the rest of the spokes the next greatest thickness; while the spokes themselves have been widened and a considerable part of the intermediate spaces have been filled up with later and thinner deposit; the crenation of the rim is not very easily seen.

Genus MYRIOTROCHUS, Steenstrup.

*Myriotrochus Rinkii*, Steenstrup. (Pl. XXVII. figs. 5-9.)

1851. *Myriotrochus Rinkii*, Steenstrup, Videnskab. Middel. fra den naturhist. Forening i Kjöbenhavn, p. 55, pl. iii. figs. 5-7.

1852. *Chirodota brevis*, Huxley, Sutherland's Voyage Baffin's Bay, vol. ii., Appendix, p. cxi.

1877. *Myriotrochus Rinkii*, Theel, "Quelques Holothuries des Mers de la Nouvelle Zemble," Nov. Acta Reg. Soc. Sc. Upsala, ser. iii. p. 3, pl. i.

1881. *Myriotrochus Rinkii*, Duncan & Sladen, Memoir Echinodermata of the Arctic Sea to the West of Greenland, p. 15, pl. i. figs. 20-24.

1882. *Myriotrochus Rinkii*, Danielssen & Koren, Norwegian North-Atlantic Exped., Holothuroidea, p. 28, pl. v. figs. 1-4, pl. xiii. fig. 1.

1892. *Myriotrochus Rinkii*, Ludvig, "Die Rädchen der Synaptiden," Zeits. f. wiss. Zool. vol. liv. p. 358, pl. xvi. figs. 12-14.

1900. *Myriotrochus Rinkii*, Ludvig, Fauna Arctica, p. 160.

1902. *Myriotrochus Rinkii*, Östergren, "Holothuroidea of Northern Norway," Bergens Mus. Aarbog, no. 9, p. 14.

Ludvig and other recent authors have united *Oligotrochus vitreus*, M. Sars (Fauna littor. Norveg. part 3, 1877, p. 49, pl. vii. fig. 1), with *Myriotrochus*; but Östergren, in his recently published paper, again separates them. He has examined a large number of specimens, and his opinion I here follow, though not without much doubt. I have frequently taken the form *Oligotrochus vitreus* in West Norway, but on now examining them I can find no spicules; they have evidently from some cause been destroyed. Not having it in my power therefore to carry out such an investigation as that made by Herr Östergren, I am in no position to call in question the justice of his view. While *Myriotrochus* (= *Oligotrochus*) *vitreus* lives in deep water on the west and south coasts of Norway, *Myriotrochus Rinkii* (typical) has only now, in Östergren's paper, been added to the fauna of the colder fiords of West and East Finmark.

I dredged *Myriotrochus Rinkii* in 1890 in 2-5 fathoms in Klosterelv Fiord, and in 5-30 fathoms in the inner part of Lang Fiord.

The two forms above referred to are the only known recent representatives of the genus; but M. Schlumberger has described under the name *Stueria elegans* ("Note sur les Holothuridées du Calcaire Grossier," Bull. Soc. Géol. de France, sér. 3, vol. xvi. p. 440, figs. 12-14) spicules which it seems difficult to distinguish from those of the recent form. In a subsequent paper ("Seconde Note sur les Holothuridées fossiles du Calcaire Grossier," *l. c.* vol. xviii. p. 191) M. Schlumberger refers the species which he had previously described to the genus *Myriotrochus*, and adds a second fossil species, *Myriotrochus operculum*.

The wheel-spicules of *Myriotrochus Rinkii* are very beautiful objects. Most of the illustrations which have been already given are not fully satisfactory, as not giving a side view; but the oblique figures of Ludwig (figs. 12 & 13) are excellent. His fig. 14 seems to have been drawn from a specimen in which calcification has been carried further than in any specimen previously figured or in any that I have myself seen. The spokes have widened at the middle of their length and become united with each other, but small intervening spaces remain open near their junction with the central boss.

In the early stage of a wheel from the central boss there are developed all round radiating bars or spokes (fig. 5). These spokes at their distal extremity then widen out laterally, and, uniting with each other, form the tyre which completes the wheel; then from the upper and inner edge of the tyre a series of triangular processes are projected horizontally inwards, and overhang the spokes which are attached to the other edge of the tyre; these triangular lobes are always somewhat more numerous than the spokes. The structure will be best understood by comparison of the figures here given—fig. 6 representing the upper, fig. 7 the under surface, and fig. 8 the wheel as seen obliquely. The spokes at their attachment to the central boss are bent slightly upwards, and then with a gentle arching curve downwards and ultimately upwards again they form junction with the tyre\*. The double bend of the spokes, which is very elegant in itself, keeps the entire thickness of the wheel as seen from the side (fig. 9). I do not find any material difference in the wheels of this species as found in East Finmark when compared

\* Ludwig's fig. 13 admirably illustrates the double curve of the spokes.



with others in my collection from Greenland; the number of spokes in the Finmark specimens ranges from sixteen to twenty-one.

### Genus TROCHODERMA, Theel.

#### *Trochoderma elegans*, Theel.

1877. *Trochoderma elegans*, Theel, "Quelques Holothuries des Mers de la Nouvelle Zemble," Nov. Acta Reg. Soc. Sc. Upsala, ser. iii. p. 11 (separate copy), pl. ii.

This genus, like the last, is furnished with wheel-like spicules, but the tyre is rounded and armed with spines instead of furnished with triangular inward-directed processes, as in *Myriotrochus*.

Östergren writes:—"I have now before me a specimen of this species which is new to the Norwegian fauna; it was obtained by G. O. Sars at Mortensnes, in the Varanger Fiord" ("Holothuroidea of Northern Norway," Bergens Mus. Aarbog, 1902, p. 21).

### EXPLANATION OF PLATE XXVII.

- Fig. 1. *Eupyrgus scaber*, Lütken, magnified; the actual length indicated by the line below.  
 Fig. 2. The same. Spicules as seen from above.  
 Fig. 3. The same. Spicules as seen from the side.  
 Fig. 4. *Chirodota lævis*, Fabricius. A spicule.  
 Fig. 5. *Myriotrochus Rinkii*, Steenstrup. Wheel-spicule in early stage of development.  
 Fig. 6. The same. Wheel-spicule seen from above.  
 Fig. 7. The same. Wheel-spicule seen from below.  
 Fig. 8. The same. Wheel-spicule seen obliquely.  
 Fig. 9. The same. Wheel-spicule seen from the side.

### XL.—On new Species of Histeridæ and Notices of others. By G. LEWIS, F.L.S.

THIS is the twenty-second paper on the Histeridæ published in this Magazine, and the last before the issue of a new catalogue of the species belonging to the Family. In these papers about 418 species have been described.

The Munich Catalogue of 1868 recorded 1151 species, but this number is reduced to about 1050 by the names that fall into synonymy. About 2316 species are known at present, and of these 1727 are represented in my collection; 631 of these are authors' types, 296 species are represented by

specimens compared with the types, and 806 consist of specimens named in the ordinary course of study.

The species not represented in my collection number about 589; and of these 191 have been described by Marseul, and most of his types, but not all, are in the Museum of Paris, 34 others are in the British Museum, and 9 are in the Fry Collection. About 133 are species described by Schmidt, and the types presumably are in his collection. The remaining, about 222, are in various collections in Europe, America, and Australia. The figures I give are approximate only, but they are fairly correct.

Three species described here belong to the Godman Collection, and the types will be deposited in the British Museum later.

*List of Species and new Genera.*

Phylloma corticale, F.	Eblisia incisipyge, Mars.
— plagigerum, Lew.	Contipus digitatus, Mars.
Petalosoma, gen. nov.	Hister confector.
— hirtipes, Lew.	— tricuspis.
Eutidium, gen. nov.	— sulcipygus, Lew.
— pacale.	— exlegis.
Orphinium, gen. nov.	Notodoma orientale.
Teretriosoma peruanum, Er.	Orectoscelis, gen. nov.
Apobletes tristriatus.	— humeralis.
Althanus, gen. nov.	Saprinus pygidialis.
— teretrioides.	— calatravensis, Fuente (1899),
Pachycrærus Alluandi, Mars.	=bitterensis, Mars. (1862).
— assinius, Mars.	— navasi, Fuente (1900),
Eblisia obliqua.	=detersus, Ill. (1807).
— pulsata.	

*Phylloma corticale*, F. Syst. El. i. p. 91 (1801), is at present the only species to be included in *Phylloma*. The mentum is transverse and narrow, and the prosternal keel is sinuous laterally and not narrowed. The body is very flat.

*Phylloma plagigerum*, Lew. Biol. Cent.-Am., Col. vol. ii. pt. 1, p. 183, pl. iv. fig. 16 (1888).—This species cannot be included in *Orphinium* by reason of the form of the mentum, and it is better therefore to assign it temporarily to *Holo-lepta*, notwithstanding the swollen mandibles.

PETALOSOMA, gen. nov.

Body very flat and oblong-ovate; mandibles elongate and swollen, not dentate on the inner edge; mentum transverse, not very narrow, and deeply incised anteriorly. The head in the male is not excavated behind the mentum, but has a very

feeble median canaliculation; the antennæ has a distinctly oval club; the pygidium is doubled under the propygidium, and the fourth and fifth abdominal segments are scooped out to receive it; the tarsi are all distinctly hirsute.

This genus is established on the characters of *Phylloma hirtipes*, Lew., of which the female is unknown to me.

#### EUTIDIUM, gen. nov.

Body oval, somewhat convex; mandibles short and robust, arched on the outer edge, dentate within, extremities acute; mentum nearly quadrate, incised anteriorly; prosternal keel narrowed before the coxæ. The other characters resemble those of *Phylloma*.

Type *Phylloma facetum*, Lew.

#### *Eutidium pacale*, sp. n.

Ovatum, convexiusculum, nigrum, nitidum; fronte tenuiter punctulata; pronoto lateribus subtiliter punctulato; clytris striis 1-2 integris, 3 brevi; propygidio parce punctato, apice biimpresso; pygidio dense punctato, apice anguste lævi; pronoto mesosternoque tenuiter punctulatis.

L. 5 mill.

This species differs from *E. facetum*, Lew., in the thorax being narrower anteriorly and the general outline being therefore more distinctly oval, in the second dorsal stria being complete, in the propygidium being punctate on its disk, and the pygidium being only very indistinctly marginate at the base. From *E. bahiense*, Mars., it differs also in form, thoracic punctuation, and dorsal striæ. The form of the pygidium of *E. facetum*, Lew., is shown in tab. iv. fig. 17 a, Biol. Cent.-Amer., Col. vol. ii. pt. 1 (1888).

*Hab.* Marco da legua Para (*E. Gounelle*, 1895).

#### ORPHINIUM, gen. nov.

Body oblong-ovate, somewhat convex above; mandibles elongate, sometimes dentate, sometimes swollen and asymmetrical on the inner edge; mentum transverse, not very narrow, with two lobe-shaped excavations in male; head not excavated. Similar in other characters to *Hololepta*. The form of the mentum seems to suggest an affinity to *Ocysternus*, see Marseul's Mon. p. 196 (1853).

The species to be included in this genus are: *Phylloma labrosum*, *tuberculatum*, *exutum*, and *angulare*, Lew., and *oblutum*, *mandibulare*, *monodon*, and *Maragnoni*, Mars.

*Teretriosoma peruanum*.

*Teretrius peruanus*, Er. Wieg. Arch. i. p. 91 (1847).

The type of this species in the Berlin Museum has been examined at my request by Herr H. Kolbe, and I am able to state that it has no prosternal striæ and it therefore belongs to the genus *Teretriosoma*. It is a species which requires redescription.

NOTE.—In 'Departmental Notes on Insects that affect Forestry,' no. 1, p. 20 (1902), published in India, Mr. E. P. Stebbing states that *Teretriosoma cristatum*, Lew., *intrusum*, Mars., and *Stebbingii*, Lew., have been found by him in the galleries in trees made by a species of *Sinoxylon* in the Shahdera and Changa Manga plantations of the Lahore division of the Punjab; and also that *Niponius Andrewesi*, Lew., has been found in the galleries made by a *Scolytus*.

*Apobletes tristriatus*.

*Apobletes foliaceus*, Mars. Mon. p. 245, t. 6. f. 3 (1853); Sch. Ann. Soc. Ent. Fr. lxi. p. 290 (1892).

This is a new name for a species with three dorsal striæ, described erroneously by Marseul as *A. foliaceus*, Paykull.

## ALTHANUS, gen. nov.

Body cylindrical, somewhat elongate, and truncate; head retractile, forehead concave, mandibles robust and coequal; antennæ, scape as long as the funicle and club together, funicle with 7 short joints, club rather large and 4-jointed; thorax, marginal stria very fine, antennal fossettes in the angle and wholly open below; elytra, striæ chiefly obliterated; prosternum keel narrow; mesosternum rather wider than long and markedly marginate and sinuous anteriorly; anterior tibiæ 4-dentate, apical tooth very robust, posterior tibiæ not spinose except at their apices.

The sterna in this genus resemble those of *Cylistix* and the antennal fossettes are similar to these of *Platysoma*.

*Althanus teretrioides*, sp. n.

Cylindricus, brunneus, nitidus; fronte stria laterali valida in medio angulata; pronoto stria marginali tenuissima necnon basi continuata, stria laterali pone oculos interrupta; elytris striis dorsalibus inconspicuis; prosterno inter coxas bistriato; mesosterno valide marginato; tibiis posticis extus haud denticulatis.

L.  $2\frac{1}{2}$  mill.



Cylindrical, subelongate, truncate, brown and shining; the head, surface with shallow punctures not densely set, but intermixed with fine points, forehead concave, with a strong lateral stria angulate in the middle, at the angle the canthus of the eye projects; the thorax is punctured somewhat similarly to that of the head, the marginal stria is very fine and continued along the base, at each of the anterior angles there is a well-marked inner stria and behind the head there is another detached stria which is somewhat crenulate and bent backwards at either end; the elytra, striæ, inner humeral fine and complete, first dorsal is basal and anteriorly bent, second is straighter and a little longer, the sutural commences just behind the middle of the dorsum and continues along the base, and then turning backwards apparently represents a short third dorsal stria, the surface is sparingly punctulate posteriorly; the pygidia are more distinctly punctured; the prosternum, keel narrow and striate between the coxæ; the mesosternum is markedly marginate, wider than long, and sinuous anteriorly; the legs, anterior tibiæ are strongly angulate at the base on the inner edge, and there is a groove and an overlapping edge in the femur to receive the projection on the outer edge, the tibiæ are 4-dentate, apical tooth being very robust, intermediate tibiæ 3-4-spinose, posterior without spines except two at the tarsal end.

*Hab.* Mentawai Islands (*Modigliani*, 1894). In the Genoa Museum collection and my own.

### *Pachycrærus Alluandi*.

*Macrosternus Alluandi*, Mars. Bull. Soc. Ent. France, (6) viii. p. ix (1888).

*Pachycrærus latus*, Lew. Ann. Soc. Ent. Belg. xxxviii. p. 215 (1894).

I have lately obtained Marseul's type of *Macrosternus Alluandi*, and find it is identical with *Pachycrærus latus*, Lew. There is no doubt of its being a *Pachycrærus*, but Marseul's specific name has priority to mine.

### *Pachycrærus assinius*.

*Macrosternus assinius*, Mars. Bull. Soc. Ent. Fr. (6) viii. p. ix (1888).

I have also acquired the type of this species; the thoracic fossettes are similar to those of *Pachycrærus*, and so are the general characters of the species, except that the anterior outline of the mesosternum "is nearly straight in front," as Marseul says, but I think this is only so on the surface.

There is only one species at present properly placed in  
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*Macrosternus*, viz. *Lafertei*, Mars., and its thoracic fossettes for the reception of the antennal club are entirely open below.

*Eblisia obliqua*, sp. n.

Oblongo-ovata, parum convexa, nigra, nitida; pronoto stria laterali integra a margine haud distante; elytris striis dorsalibus 1-3 integris, 4-5 brevibus; pygidio utrinque oblique sulcato; tibiis anticis 4-dentatis.

L. 3 mill.

Oblong-oval, somewhat convex, black and shining; the head, frontal stria fine, complete, and straight anteriorly; the thorax impunctate, lateral stria parallel to the margin, with a narrow interstice and continuing behind the head; the elytra, striae 1-3 dorsal complete, 4 apical and dimidiate, 5 a little longer than the fourth, sutural and two humeral wanting, but the oblique basal is feebly represented; the propygidium has a broad transverse band of punctures which leaves the base almost smooth; the pygidium has two deep oblique furrows, one on either side behind the lateral angles, on the area between the furrows the punctuation is smaller and less close than that of the propygidium and its apex is microscopically punctured only; the prosternum is without striae; the mesosternum is emarginate and has a complete stria, which is only marginal in the middle as it passes obliquely along the lateral border, within the anterior angles on either side there is a short sinuous stria; the metasternum has a very faint median channel; the anterior tibiae are 4-dentate.

The narrow interstice to the thoracic margin distinguishes this species from *E. lunaticus*, Mars., and others.

*Hab.* Port Moresby, New Guinea.

*Eblisia pulsata*, sp. n.

Ovalis, parum convexa, nigra, nitida; pronoto stria laterali integra, interstitiis angustatis; elytris striis 1-3 integris, 4-5 brevibus; propygidio punctato; tibiis anticis 4-dentatis.

L.  $3\frac{1}{8}$  mill.

Oval, somewhat convex, black and shining; the head, frontal stria well marked, complete, and slightly sinuous anteriorly; the thorax impunctate, lateral stria complete, parallel, close to the margin, and continued behind the head; the elytra, striae 1-3 complete, 4 apical and not quite dimidiate, 5 slightly longer, the sutural and the humeral striae (except the oblique stria which is extremely fine) are wanting; the propygidium is distinctly punctate, points somewhat large

and irregular, not very close; the pygidium, on the basal area the punctures are less close than those of the propygidium and the apex is smooth, behind the anterior angles there is an impression on either side which apparently represents a rudimentary furrow; the prosternum is not striate; the mesosternum is emarginate, striæ similar to those of the last species, except that the striæ at the angles are angulate, not sinuous; the anterior tibiæ are 4-dentate.

The species, like the last, has a narrow thoracic lateral interstice.

*Hab.* Palembang, Sumatra.

*Platysoma incisipyge*, Mars. Bull. Soc. Ent. Fr. (6) iii. p. 67 (1883), is a species of *Eblisia*. Marseul suggested the generic name of *Nicotikis* for it, but did not characterize it, nor did he recognize that four species previously described by him as *Phelister lunaticus*, *celebius*, *speculipygus*, and *Platysoma Steinheilli* were congeneric with it.

*Contipus digitatus*, Mars. Mon. p. 547 (1853).—In the Munich Catalogue the name of the genus is changed to *Contopus*, a name preoccupied in Aves. I think the type of this species is in the British Museum from a collection purchased from Sallé, in whose collection probably Laferte's was incorporated. In Marseul's collection the species is now represented by specimens of *C. flexuosus*, Sch., a common species in S. Africa.

### *Hister confector*, sp. n.

Ovalis, convexiusculus, niger, nitidus, supra tenuiter punctulatus; fronte stria integra antice sinuata; pronoto stria externa abbreviata, interna haud interrupta; elytris striis 1-4 integris, 5 basi inconspicua, suturali ultra medium abbreviata; propygidio punctulato; tibiis anticis 6-7-denticulatis.

L.  $4\frac{2}{3}$  mill.

Oval, rather convex, black and shining, lightly punctulate above; the head, forehead not impressed, stria complete and sinuous anteriorly; the thorax, outer lateral stria much abbreviated at the base, inner lateral shortened a little at the base and continued behind the head where it is irregularly crenulate, the lateral interstice is rather wide; the elytra, striæ, outer humeral very short and indistinct, only visible behind the shoulder, inner humeral strong and well marked and ceasing at the base, where it meets the oblique humeral

stria, 1-4 dorsal strong and complete, 5 apical and clearly dimidiate, but it is punctiform and vaguely continued to the base, the sutural is apical but passes the middle; the propygidium is sparingly and finely punctulate, with finer points interspersed; the pygidium is evenly punctulate; the prosternum is very sparsely punctulate and microscopically strigose, keel not striate, anterior lobe marginate; the mesosternum is sinuous anteriorly and the stria irregularly crenulate and complete, the transverse sutural stria is also crenulate; the anterior tibiæ are 6-7-denticulate.

The general sculpture, especially of the pygidia, and the form of the anterior tibiæ resemble those of *H. cavifrons*, Mars., and allies.

*Hab.* Temax, N. Yucatan (*Gaumer*). One example in the Godman Collection.

*Hister tricuspis*, sp. n.

Ovális, parum convexus, niger, nitidus, supra tenuiter punctatus; fronte haud impressa, stria integra; pronoto striis lateralibus crenatis; elytris striis 1-2. integris, 3 dimidiata, suturali brevi media; pygidio margine antice 3-punctato; prosterno haud striato, lobo conspicue marginato; tibiis anticis obtuse tridentatis.

L.  $4\frac{1}{2}$  mill.

Oval, rather convex, black and shining, finely punctulate above; the head, stria complete and almost straight anteriorly; the thorax, marginal stria is very fine and interrupted behind the middle of the neck, the outer lateral is irregularly crenulate behind the head and shortened posteriorly near the middle, the inner lateral stria is somewhat crenulate and nearly reaches the base and anteriorly apparently joins the outer stria well within the angle as the interstice is rather wide; the elytra, the humeral striæ are wanting, the 1-2 dorsal are complete, 3 dimidiate, 4 represented by a basal puncture, sutural is short and discal; the propygidium is sparingly punctulate; the pygidium is almost smooth and has three punctures at equal distances along its anterior margin, the median point is markedly triangular; the prosternum, the anterior lobe is rather wide with a strong marginal stria, the keel is without striæ; the mesosternum is slightly arched anteriorly and margined with a stria irregularly but not markedly crenulate; the anterior tibiæ are obtuse, 3-dentate, the apical tooth being bifid.

This species somewhat resembles *H. politus*, Lew.

*Hab.* Temax, N. Yucatan (*Gaumer*). One example in the Godman Collection.



*Hister sulcipygus*, Lew. Ann. & Mag. Nat. Hist. ser. 6, iii. p. 282 (1889).—A second specimen of this very distinct species has been brought home from the south of Abyssinia by Herr Oscar Neumann and it is now in the Berlin Museum. There are no sulci in the pygidium, and therefore it is likely (unless they have relation to the sexes) that the sulci I described are abnormal.

*Hister exlegis*, sp. n.

Oblongus, subquadratus, parum convexus, niger, nitidus, supra undique punctulatus; stria frontali integra; pronoto striis lateribus integris; elytris striis 1-3 integris, 4 et suturali brevibus; propygidio pygidioque punctulatis; tibiis anticis obtuse 4-dentatis.

L.  $8\frac{1}{4}$  mill.

Oblong, somewhat quadrate, rather convex, black and shining, wholly punctulate above; the forehead, stria complete, somewhat fine and nearly straight anteriorly; the thorax, lateral striæ both complete, not deeply impressed, inner stria continued behind the head; the elytra, striæ 1-3 complete, shallow but relatively a little wide, 4 discal and vague, sutural apical and bent, inner humeral dimidiate and not joining the oblique basal stria, there is no outer humeral; the pygidia are finely and evenly punctured; the prosternum, anterior lobe marginate; the mesosternum emarginate anteriorly with a complete marginal stria, all the sternal plates are very finely punctulate; the anterior tibiæ have 4 obtuse teeth, tooth nearest the base inconspicuous, and the under surfaces are rugosely punctured; the other tibiæ are multispinose.

The surface-sculpture and the elytral striæ somewhat resemble those of *H. semigranosus*, Mars., but the latter is an opaque species.

*Hab.* Abyssinia.

NOTE.—*Hister Czikanni*, Csiki. Zichy Ergebn. ii. p. 106, fig. 2 (1901), = *H. Sedakovi*, Mars. Mon. p. 548 (1861).

*Notodoma orientale*, sp. n.

Globosum, rufo-brunneum, nitidum; pedibus flavis; pronoto dense punctato; elytris striis 1-2 integris, 4 et suturali antice conjunctis, interstitiis punctulatis; prosterno distincte punctato, striis lateribus conspicuis.

L. 3 mill.

Globose, reddish brown, with two pale blotches on the base

of each elytron; the forehead is somewhat closely punctured, the punctures are shallow and somewhat irregular, the lateral striæ are anteriorly slightly bent inwards, the epistoma is more finely punctured than the vertex of the head; the thorax, marginal stria complete and crenulate anteriorly, the surface except in the region before the scutellum is closely and distinctly punctured; the elytra, striæ, inner humeral is shortened at the base but continues along the apical margin and joins the sutural stria, outer humeral laterally complete, 1-2 dorsal complete, 3 discal and indistinct, 4 shortened apically and joined to the sutural at the base, the punctuation of the dorsal region is fine and sparse except between the interstices of the first and second striæ and broadly along the apical border, where the punctures are closer and more distinct; the pygidia are clearly punctured; the prosternum, the keel is evenly and distinctly punctured and the lateral striæ are well marked and turn slightly inwards anteriorly; the anterior tibiæ are 9-10-spinose.

The punctuation of this species (especially that on the thorax and prosternal keel) is more conspicuous than that of any other known at present. The striæ on the meso- and metasterna resemble those of *N. fungorum*, Lew., and others.

*Hab.* Ruby Mines, Birma (*Doherty*). In Mr. Fry's Collection and my own.

#### ORECTOSCELIS, gen. nov.

In founding a new genus on a single species it is somewhat difficult to select characters which may ultimately be deemed important, but those given here are wholly different to any in the allied genus *Chlamydopsis*. The antennæ, scape rather long and bent and obtusely angular on its upper edge; the basal joint of the funicle is swollen and longer than the next joint, which is very narrow; joints 4-8 are small, moniliform, and of equal size; the club is apparently solid and remarkably long and narrow, longer than joints 2-8 together. The anterior tibiæ are rather narrow and angulate on the outer edge at the point where the tarsal grooves end; the intermediate and posterior tibiæ are short and moderately dilated, in form resembling those of an *Eretmotus*; the anterior and intermediate femora and tibiæ, when folded in repose, fit into grooves in the sterna. The prosternum is without a keel, parallel laterally between the coxæ and almost truncate at its base.

*Orectoscelis humeralis*, sp. n.

Oblongus, piceus, punctatus; pronoto antice bituberculato; elytris humeris valdissime prominentibus, striis suturalibus integris, cæteris nullis; pedibus brevibus, tibiis intermediis et posticis latis.

L.  $2\frac{1}{2}$  mill.

Oblong, dorsum somewhat gibbous, piceous, semiopaque and coarsely and densely punctate above and below; the head is without striæ; the thorax somewhat quadrate but slightly widening out to its base, behind the middle of the neck are two tuberculate processes which widen out at their bases, along the lateral edges the coarse punctures give place to small tubercles; the elytra, there is a sutural stria which is continued less conspicuously behind the thorax and along the apical margin, on either shoulder there is a large semi-circular elevation, not quite perpendicular but leaning outwards, hollow in its centre, with its inner edge densely clothed with a very conspicuous, short, flavous pubescence, the upper rim is evenly punctulate, punctures relatively fine as compared with those of the dorsum, the lateral edges are somewhat tuberculate but less conspicuously so than those of the thorax; the propygidium and pygidium are punctured like the dorsum, except on the apical rim of the latter, where there are only small points. The prosternum is very feebly sinuous at its base, there is a marginal stria which is parallel laterally behind the anterior angles as far as the tibial groove, and it then follows the outline round the base; the mesosternum is also marginate; the punctuation is similar on all the sterna and on the first segment of the abdomen as well as on the upper surface.

*Hab.* Townsville, Queensland (*F. P. Dodd*, 16th December, 1902). One example from an ants' nest.

Not much is known of the habits of the curious Australian Histerids included in the genus *Chlamydopsis*. *C. striatella*, Westw., and *C. inquilina*, Lew., have been reported as occurring in ants' nests, and it is probable that all the species are truly formicarious. Blackburn has described four species, but his specimens are stated to be unique and appear to have been captured fortuitously, two on fences and one in a pool of water. There are probably many species yet to be discovered. The insects have no special form, such as the cylindricity seen in *Tryponeus*, which at once gives a clue to their mode of life; but they seem to have been subjected to freer conditions of environment, such as that which I think has given rise to the various forms of *Sternocælis* (*Ann. & Mag. Nat. Hist.* x. p. 232, 1892).

CHLAMYDOPSIS, Westwood, Trans. Ent. Soc. Lond.  
p. 317 (1869).

I propose to retain as the type of this genus *C. striatella*, Westw., because the author of the genus characterizes this species more fully than *C. Duboulaii*, and both species cannot now be assigned to the same genus. In *C. striatella* the legs are elongate and constricted at their bases from a point close to that where the tarsal groove ends, and in this respect differ from those of *Orectoscelis*, which are similar to an *Eretmotus*. In *C. striatella* also there is a broad prosternal keel, which is marginate and widened out before the coxæ towards the lateral thoracic edges, and the mesosternum is bisinuous in outline anteriorly. *C. inquilina* is a typical *Chlamydopsis*, but should have been described as "pronoto haud transverso," for its thorax is nearly square and evenly reflexed on three sides. In the genus *Orectoscelis* there is no prosternal keel, and *C. Duboulaii* certainly (from Westwood's figure) and *C. sternalis*, Blk., probably belong to it. Excellent outlines of the sterna are given in the 'Thesaurus Ent. Oxon.,' 1874, of Westwood's two species, and serve to show the differences in the sternal structure in the two genera.

*Saprinus pygidialis*, sp. n.

Ovalis, parum convexus, niger, nitidus; fronte concava, punctata, stria obsoleta; pronoto circum punctato, stria integra; elytris striis dorsalibus 1<sup>a</sup> basi abbreviata, 2<sup>a</sup> dimidiata, 3<sup>a</sup> brevissima, 4<sup>a</sup> et suturali basi conjunctis, humerali externa integra; prosterno acute carinato, striis in foveam ascendentibus; tibiis 5-6-denticulatis.

L. 3½ mill.

Oval, somewhat convex, black and shining; the head concave behind the epistoma, with the surface evenly, not densely, punctured; the thorax, marginal stria complete, with the anterior and lateral borders broadly punctate, disk widely and finely punctulate; the elytra, striæ, outer humeral complete and bent apically, inner wanting, oblique basal very fine, first dorsal well shortened apically, second dimidiate and third one third of the elytral length, fourth same length as the third and joined to the sutural, which is almost complete; the propygidium and pygidium are clearly and somewhat densely punctured, before the apex there is a deep transverse sulcus shaped like a widened-out V with sinuous edges, behind the sulcus the apex is almost smooth; the prosternum is transversely smooth at the base and the striæ



are divergent anteriorly and terminate anteriorly in a fovea, posteriorly they do not cross the smooth area; the mesosternum is straight anteriorly and finely marginate, evenly and clearly but not densely punctate; the anterior tibiæ are 5-6-denticulate.

This species should be placed in the same section as *S. aterrimus*, Er., *inversus*, Lew., *Lacordairei*, Mars., *connectens*, Payk., and *arcipygus*, Sch. In these species the prosternal striæ terminate in a fovea in the anterior part of the keel.

*Hab.* Venta de Peregrino, Guerrero (*H. H. Smith*). One example (♀) in the Godman Collection.

NOTE.—Signor Fuente has kindly sent me the types of *Saprinus calatravensis* and *navasi*, Fuente, and I find the first = *bitterensis*, Mars., and the second *detersus*, Illig. The type of *navasi* is highly punctate, and the smooth space between the second and third dorsal striæ is nearly obliterated; but I have an example exactly similar in a series of *detersus* I brought from Central Spain.

XLI.—*Descriptions of new Lizards in the Collection of the British Museum.* By G. A. BOULENGER, F.R.S.

*Gekyra yunnanensis.*

Head and limbs moderately elongate. Head oviform; snout as long as the distance between the eye and the ear-opening, which is small and round; head covered with finely granular scales, which are larger on the snout; rostral nearly twice as broad as deep, with a short median cleft above; nostril pierced between the rostral, the first upper labial, and three nasals, the upper of which is separated from its fellow behind the rostral by several minute granules; 10 upper and 10 lower labials; symphysial pentagonal, the posterior angle wedged in between the two median of a series of small chin-shields. Scales uniformly granulate on the back, limbs, and throat, larger, flat, and imbricate on the belly. Digits free, strongly dilated, with large transverse lamellæ which are entire under the first digit, whilst under the other digits three or four of the distal are chevron-shaped and divided by a median groove. Tail cylindrical, covered with small imbricate scales above and beneath. Male with an angular series of 18 femoro-præanal pores. Grey-brown above, dotted with

greyish white, and with blackish wavy cross-bars on the back and tail; a dark streak on each side of the head, passing through the eye; lower parts greyish white.

	millim.
Total length .....	75
Head .....	11
Width of head .....	8
Body .....	29
Fore limb .....	13
Hind limb .....	16
Tail .....	35

Two specimens, male and young, from Yunnan Fu, taken on a wall by Mr. John Graham, of the China Inland Mission.

The nearest ally of this species is the recently described *G. larutensis*, Blgr.

### *Lialis Jicari*.

Snout acutely pointed, not truncate at the tip, twice as long as broad, 4 or 5 times as long as the eye, which is small and surrounded by a rudimentary circular lid; ear-opening small, oval, oblique. Snout covered with small irregular plates, back of head with small scales; two large supra-orbitals; rostral a little broader than long, on the lower surface of the snout; nasal small; 17 or 18 upper labials, 3 rows of small scales between them and the orbit; symphyseal longer than broad. 22 scales round the middle of the body; the enlarged ventrals in 100 to 105 pairs. 6 præanal pores. Pale yellowish or pinkish brown above, speckled with blackish; a faint dark vertebral streak; a well-defined dark brown dorso-lateral streak, expanding anteriorly into a broad band occupying the side of the head; a light streak along the lower lip, widening on the body, where it forms a band which is ill-defined above and sharply defined by a dark line below; belly dark grey-brown, or yellowish with dark longitudinal streaks, of which one along the middle is the most distinct.

From snout to vent 300 millim.

Three specimens from the Fly River, British New Guinea. Presented by Mr. A. H. Jicar, Resident Magistrate at Dar, British New Guinea.

The shape of the snout, the number of scales round the body, and the number of præanal pores distinguish this new species from *L. Burtoni* and its numerous varieties.

### *Anadia biteniata*.

Habit lacertiform. Snout obtusely pointed; frontonasal a little longer than broad; præfrontals forming a median suture;

four supraoculars, first small (exceptionally fused with the first supraocular), frontal slightly longer than the frontoparietals, about the same size as the interparietal; a single nasal; loreal single or divided into two superposed shields; a series of small infraorbitals; six or seven upper and as many lower labials; chin-shields, one anterior and four pairs, the two first pairs forming a suture; collar-shields 8 or 10; 12 to 16 transverse series of scales from the chin-shields to the edge of the collar. Scales quadrangular, subequal, ventrals a little broader than dorsal; 34 or 36 scales round the middle of the body and 34 to 40 between the occiput and the base of the tail. 4 anterior and 6 posterior præanals. Male with 8 to 10 femoral pores. Caudal scales similar to those on the body. Brownish or olive above, spotted with blackish, with a more or less distinct light dorso-lateral streak; this streak very sharply marked in the young, white, edged with black; lower parts whitish, or belly bluish grey, with or without scattered black dots.

	millim.
Total length.....	182
Head .....	15
Width of head .....	9
From end of snout to fore limb.....	25
"          "          vent.....	65
Fore limb.....	19
Hind limb .....	23
Tail .....	117

Several specimens from Escorial and Culata, Venezuela, at an altitude of about 10,000 feet, collected by Sr. Briceño.

*Euspondylus brevifrontalis.*

Head rather small, not distinct from neck ; body elongate. Snout short, obtuse ; frontonasal longer than broad, in contact with the frontal, which is about the same size ; two supra-orbitals, only the first in contact with the frontal ; interparietal at least twice as long as broad ; nasal in contact with the first supraciliary, or separated by the single loreal ; a series of moderately large infraorbitals ; six upper and six lower labials ; chin-shields, one anterior and four pairs, the two first pairs forming a suture ; collar-shields ten ; 15 to 17 transverse series of scales from the chin-shields to the edge of the collar. Dorsal scales elongate-quadrangular, perfectly smooth, nearly as long as, but narrower than, the ventrals ; lateral scales smaller, rounded ; 34 or 36 scales round the middle of the body, including ventrals, and 41 to 47 between





*Mabuia polytropis*.

Snout moderate, obtuse. Lower eyelid with an undivided semitransparent disk. Nostril behind the vertical of the suture between the rostral and the first labial; a postnasal; anterior loreal in contact with the first labial; supranasals in contact behind the rostral or narrowly separated; fronto-nasal broader than long; præfrontals forming a median suture; frontal as long as or a little shorter than the frontoparietals and interparietal together, in contact with the second and third supraoculars; four supraoculars, second largest and usually touching the præfrontal; six or seven supraciliaries; frontoparietals distinct; interparietal a little longer than the frontoparietals, completely separating the parietals; a pair of nuchals; subocular between the fourth and fifth or fifth and sixth upper labials, at least twice as long as these shields, not narrowed inferiorly. Ear-opening oval, smaller than the eye-opening, with two or three very small lobules anteriorly. Dorsal scales with nine or eleven strong keels; 32 to 36 scales round the middle of the body, nearly equal in size. The hind limb reaches the elbow of the adpressed fore limb or a little beyond. Subdigital lamellæ smooth. Tail once and three fourths to nearly twice as long as head and body. Bronzy olive above, with dark brown spots forming more or less regular transverse bars; a dark brown streak on each side of the head and neck, passing through the eye, becoming more or less indistinct on the body; below this brown band a greenish-white streak; a black spot in the axilla; lower parts pale green.

	millim.
Total length.....	282
Head.....	20
Width of head.....	14
Body.....	77
Fore limb.....	30
Hind limb.....	40
Tail .....	185

One specimen from the Benito River district, Gaboon, and three from Efulen, S. Cameroon. Collected by Mr. G. L. Bates.

Closely allied to *M. Raddoni*, Gray, with which I now regard *M. benitensis*, Blgr., as identical.

*Lygosoma lousiadense*.

Section *Hinulia*. Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and

one fourth or once and one fifth in the distance between axilla and groin. Snout short, obtuse. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal; a single anterior loreal; rostral forming a very long curved suture with the frontonasal, which is less than twice as broad as long and forms a short suture with the frontal; latter much narrowed posteriorly, a little shorter than frontoparietals and interparietal together, in contact with the two or three first supraoculars; five supraoculars; eight supraciliaries; frontoparietals and interparietal distinct, nearly equal in size; parietals forming a suture behind the interparietal; nuchals passing gradually into the dorsals; third, fourth, and fifth labials below the eye. Ear-opening oval, smaller than the eye-opening; no auricular lobules. 24 or 26 scales round the middle of the body, dorsals largest, dorsals and laterals rough with minute granular asperities. No enlarged præanals. The hind limb reaches the axilla or the shoulder. Digits rather elongate, slender, slightly compressed, with very narrow smooth lamellæ inferiorly; 36 to 39 lamellæ under the fourth toe. Tail once and a half to nearly twice the length of head and body. Brown above; a lighter vertebral stripe, with several dark brown spots or bars across it; a light dorso-lateral streak, beginning from the supraciliary region; a dark brown lateral band, passing through the eye; an elongate black spot, with light centre, above the axillary region; limbs with dark brown annuli; lower parts white, head and neck with dark brown spots or longitudinal lines.

	millim.
Total length.....	126
Head.....	12
Width of head.....	7
Body.....	32
Fore limb.....	15
Hind limb.....	24
Tail.....	82

Six specimens from Rossel Island, Louisiade Archipelago, collected by Mr. A. S. Meek in 1898.

### *Typhlosaurus Gregoi.*

Snout conical, strongly projecting. Rostral as long as the other head-shields together; frontal and frontoparietal equal in size, nearly twice as broad as long; a pair of large parietals, forming a suture behind the small interparietal; eye scarcely distinguishable below a small ocular; a larger supraocular; four small upper labials; symphysial very

large, extending beyond the posterior border of the rostral, its posterior border very slightly notched in the middle. Scales hexagonal, much broader than long, subequal, 16 round the middle of the body. Tail very short, rounded at the end. Whitish, above with black longitudinal lines corresponding to the series of scales, beneath with longitudinal series of blackish dots.

Total length 150 millim. ; tail 25.

A single specimen from Zoutpansberg, Transvaal, presented by Mr. J. P. Cregoe.

This species is most nearly related to *T. aurantiacus*, Peters, which differs principally in the absence of a frontoparietal distinct from the interparietal, in the shorter symphyseal, in the broader dorsal scales, and in the number of scales round the body.

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XLII.—*Descriptions of new Freshwater Fishes from Southern Cameroon.* By G. A. BOULENGER, F.R.S.

In the first part of the 'Proceedings of the Zoological Society' for 1903 (p. 21) I gave an account of a collection of fishes made by Mr. G. L. Bates in Southern Cameroon, several of the species mentioned being described as new. Many more fishes have since been received from this most energetic and successful collector, and have been acquired by the Trustees of the British Museum. Among them are representatives of further new species, of which I here offer short descriptions. These fishes are either from the Kribi River, some 15 miles from the sea, or from the Ja River (Dscha on German maps), a tributary of the Sanga River, which flows into the Congo; this Ja River is about 250 miles (by the path) from the sea-coast.

*Alestes Batesii.*

Depth of body  $3\frac{3}{4}$  to 4 times in total length, length of head 4 to  $4\frac{1}{2}$  times. Head longer than deep,  $1\frac{2}{3}$  to twice as long as broad; snout rounded, as long as or longer than diameter of eye, which is 3 to 4 times in length of head; adipose eyelid indistinct; interorbital width about half length of head; maxillary not extending to below anterior border of eye; 16 teeth ( $\frac{8}{3}$  or  $\frac{2}{6}$ ) in the upper jaw, 8 in the outer row of the lower jaw; length of lower border of second suborbital

equalling or exceeding diameter of eye. Gill-rakers rather long, 16 to 18 on lower part of anterior arch. Dorsal II 7, behind the vertical of the base of the ventrals, originating much nearer root of caudal than end of snout, longest ray  $\frac{2}{3}$  to  $\frac{4}{5}$  length of head. Adipose fin small, at least twice as far from the rayed dorsal as from the root of caudal. Anal III 12-13. Pectoral shorter than head, not reaching ventral; latter not reaching vent. Caudal forked. Caudal peduncle  $1\frac{1}{3}$  to  $1\frac{1}{2}$  as long as deep. Scales 28-29  $\frac{4\frac{1}{2}}{3\frac{1}{2}}$ , 2 between lateral line and ventral. Olive-brown above and on the sides, whitish beneath; a large round black spot on the caudal peduncle, at the base of the caudal fin; fins greyish, or blackish at the end.

Total length 245 millim.

Three specimens from the Kribi River.

This new *Alestes*, which I have great pleasure in naming after its discoverer, is closely allied to *A. macrolepidotus*, C. & V., and *A. grandisquamis*, Blgr., differing from both in the greater number of scales in the lateral line.

*Petersius major*.

Depth of body  $2\frac{1}{3}$  times in total length, length of head 4 times. Head as long as deep, twice as long as broad, with concave upper profile; snout shorter than diameter of eye, which is  $2\frac{2}{3}$  to  $2\frac{3}{4}$  times in length of head; lower jaw projecting beyond upper; maxillary extending to below anterior border of eye; outer præmaxillary teeth 4, alternating with the 8 teeth of the inner row; lower border of second suborbital as long as eye. Gill-rakers short, about 10 on lower part of anterior arch. Dorsal II 8, originating above root of ventrals and at equal distance from nostrils and from root of caudal, longest ray longer than head. Adipose fin large, its depth  $\frac{1}{2}$  to  $\frac{2}{3}$  length of head. Anal III 18, anterior rays forming a rounded lobe. Pectoral a little shorter than head, not reaching ventral; latter not reaching vent. Caudal forked. Caudal peduncle a little longer than deep. Scales 24  $\frac{4\frac{1}{2}}{3\frac{1}{2}}$ , 2 between lateral line and ventral; lateral line not extending beyond the eleventh to thirteenth scale. Silvery, yellowish on the back, a black spot above the shoulder and a black streak on each side of the tail, continued on the median rays of the caudal; iris red; dorsal fin greyish, with a band of orange-red; rays of ventral fin black at the tip.

Total length 82 millim.

Two specimens from the Ja River.

This species is most nearly related to *P. caudalis*, Blgr.,



from the Congo, which is easily distinguished by its more numerous scales ( $29-30 \frac{5\frac{1}{2}}{3\frac{1}{4}}$ ) and anal rays (19 or 20 branched), the position of the dorsal fin entirely behind the ventrals, and the smaller size.

*Nannocharax intermedius.*

Body strongly compressed, its depth 5 to  $5\frac{1}{2}$  times in total length. Head deeper than broad, more than twice as long as broad,  $4\frac{1}{3}$  to  $4\frac{1}{2}$  times in total length; snout pointed, a little shorter than the eye, the diameter of which is 3 times in length of head and equals or slightly exceeds interorbital width; mouth small, inferior, with 8 teeth in each jaw; sub-orbitals and opercle very feebly striated. Dorsal II 11, originating above base of ventrals, its first ray at equal distance from the end of the snout and the adipose fin; longest ray equals length of head. Anal III 7-8. Pectoral sharply pointed, as long as head or slightly shorter, reaching a little beyond origin of ventrals; latter reaching vent. Caudal forked, with sharply pointed lobes. Caudal peduncle twice as long as deep. Scales  $47-50 \frac{5\frac{1}{2}-6}{6\frac{1}{2}-7\frac{1}{2}}$ , 5 between the lateral line and the root of the ventral. Yellowish, with 11 to 13 brown cross-bars, which are darker on the sides; a dark blotch at the base of the caudal fin, which is traversed by a greyish bar; dorsal fin with small dark spots forming transverse series.

Total length 63 millim.

Four specimens from the Kribi River.

This species is intermediate between *N. niloticus*, Joannis, and *N. fasciatus*, Gthr.

*Barbus jœ.*

Depth of body equal to length of head,  $3\frac{1}{4}$  to  $3\frac{1}{2}$  times in total length. Snout rounded, shorter than the eye, the diameter of which is barely 3 times in length of head; mouth small, nearly terminal, with feebly developed lips; no barbels. Dorsal III 7; last simple ray not ossified, a little shorter than head; the border of the fin not emarginate, its origin nearer end of snout than root of caudal. Anal III 5. Pectoral shorter than head, not reaching ventral; latter a little behind vertical of origin of dorsal. Caudal forked. Caudal peduncle nearly twice as long as deep. Scales  $23 \frac{3\frac{1}{2}}{3\frac{1}{2}}$ , 2 between lateral line and ventral, 8 round caudal peduncle. Yellowish, the scales edged with dark brown; a large round black spot on each side behind the gill-cleft,

another at the root of the caudal, and five or six dark vertical bars between them ; a small blackish spot at the origin of the dorsal fin.

Total length 28 millim.

Three specimens from the Ja River.

Owing to the absence of barbels, this species needs comparison with one African species only, *B. Brazzæ*, Pellegrin, from the Congo, which has 8 branched rays in the dorsal fin and 28 scales in the lateral line.

*Clarias pachynema*.

Depth of body  $6\frac{1}{2}$  to 7 times in total length, length of head  $4\frac{2}{3}$  to 5 times. Head  $1\frac{2}{3}$  to  $1\frac{1}{2}$  as long as broad, smooth ; occipital process acutely pointed ; frontal fontanelle sole-shaped, about twice as long as broad ; occipital fontanelle smaller, in advance of occipital process ; eye very small, its diameter 3 to 4 times in length of snout, 6 times in inter-orbital width, which equals about  $\frac{2}{3}$  length of head and exceeds width of mouth ; band of præmaxillary teeth  $2\frac{1}{2}$  to 3 times as long as broad ; vomerine teeth conical, forming a short curved band, which in the middle is as broad as the præmaxillary band ; barbels thick and papillose at the base ; nasal barbel  $\frac{3}{4}$  to  $\frac{4}{5}$  length of head, maxillary  $1\frac{1}{3}$  to  $1\frac{1}{2}$ , outer mandibular  $1\frac{1}{4}$  to  $1\frac{1}{3}$ , inner mandibular  $\frac{3}{4}$  to  $\frac{4}{5}$ . Gill-rakers few, about 15 on first arch. Clavicles concealed under the skin. Dorsal 92-95, its distance from the occipital process  $\frac{2}{3}$  to  $\frac{1}{2}$  length of head. Anal 78-80. Dorsal and anal extending to the very root of the caudal. Pectoral  $\frac{1}{2}$  length of head, the spine feebly serrated on both sides and  $\frac{2}{3}$  to  $\frac{3}{4}$  the length of the fin. Ventrals about  $1\frac{2}{3}$  as far from the base of the caudal as from the end of the snout. Caudal  $\frac{1}{2}$  length of head. Dark olive-brown above, yellowish beneath ; no light edge to the fins.

Total length 175 to 255 millim.

Three specimens from the Ja River.

Compared with *C. laeviceps*, Gill (Paris Museum specimen from the Gold Coast, described by Sauvage in 1882), *C. pachynema* differs in the longer barbels, the narrower mouth, the shorter space between the occiput and the dorsal fin, and the shorter body. *C. Salæ*, Hubrecht, which I formerly regarded as identical with *C. laeviceps*, has a longer head, finely granulate above, a larger eye, the occipital process rounded or very obtusely pointed, and distinctly striated clavicles. These three species are very closely allied.

*Allabenchelys brevior.*

Depth of body 8 to  $8\frac{1}{2}$  times in total length, length of head  $5\frac{1}{4}$  to  $5\frac{1}{2}$  times. Head about  $1\frac{1}{4}$  as long as broad, smooth above, the bony casque, in the middle, nearly half the width of the head; supraoccipital process acutely pointed; a moderately large sole-shaped frontal fontanelle; occipital fontanelle a little smaller, partly on the occipital process; eye small, its diameter twice and a half in length of snout, 5 times in interorbital width; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical, in a crescentic band, which in the middle is as broad as the præmaxillary band. Nasal barbel about  $\frac{3}{5}$  the length of the head, maxillary  $\frac{3}{4}$  to  $\frac{5}{6}$ , outer mandibular  $\frac{2}{3}$ , inner mandibular  $\frac{1}{2}$ . Gill-rakers moderately long, 12 on anterior arch. Clavicles hidden under the skin. Dorsal fin with 65 or 66 rays, anal with 60 to 62, both narrowly separated from the caudal; the distance between the origin of the dorsal and the occipital process  $\frac{3}{4}$  the length of the head. Pectoral half the length of the head; spine feebly serrated on both sides,  $\frac{2}{3}$  the length of the fin. Ventrals small, twice as distant from the root of the caudal as from the isthmus. Caudal nearly half the length of the head. Olive-brown above, yellowish beneath.

Total length 150 millim.

Two specimens from the Ja River.

The shorter caudal region and the correspondingly shorter dorsal fin are the principal characters by which this species can be distinguished from *A. longicauda*, Blgr., also discovered by Mr. Bates in the Ja River.

*Phractura longicauda.*

Depth of body 14 times in total length, length of head  $6\frac{1}{2}$  times. Head  $1\frac{1}{3}$  as long as broad, the slightly rugose skull covered with very thin skin; snout half length of head, pointed, projecting a little beyond the mouth; space between the two nostrils at nearly equal distance from the end of the snout and from the eye; eye supero-lateral, its diameter 6 times in length of head, once and a half in interocular width; barbels papillose, maxillary and outer mandibular subequal,  $\frac{1}{3}$  length of head, inner mandibular  $\frac{1}{4}$ ; occipital process acuminate, about twice as long as broad, widely separated from the small interneural shield. Dorsal I 6, first ray longest, spinulose, as long as head; second dorsal very small, originating above last rays of anal. Anal II 6. Pectoral slightly longer than head, not reaching root of ventral. Caudal peduncle depressed, very slender,  $\frac{2}{5}$  total length. 25 dorsal

and 19 ventral shields, of which 11 are on the caudal peduncle, the last 4 united round the latter. Brownish above, speckled with dark brown, white beneath; fins spotted with blackish.

Total length 77 millim.

A single specimen from the Kribi River.

The discovery of this species, which differs from its congeners in the longer caudal peduncle, raises the number of species of the genus *Phractura* to five. I may here note that *P. lindica*, Blgr., recently described from the Upper Congo, has been found by Mr. Bates in the Kribi and Ja Rivers, and that *Doumea typica*, Sauv., has also been rediscovered in the Kribi River.

*Haplochilus cameronensis.*

Depth of body  $4\frac{1}{2}$  to  $5\frac{1}{2}$  times in total length, length of head 4 times. Snout a little shorter than the eye, the diameter of which is  $3\frac{1}{4}$  to  $3\frac{1}{2}$  times in length of head; lower jaw projecting a little beyond upper; interorbital width about  $\frac{1}{2}$  length of head. Dorsal 11 or 12, originating above middle of anal and nearer root of caudal than head; posterior rays produced in the male and a little shorter than head; first ray corresponding to eighteenth or nineteenth scale of lateral line. Anal 14 or 15, posterior rays produced as in the dorsal. Pectoral about  $\frac{2}{3}$  length of head. Caudal rounded-acuminate, middle rays as long as head in the female, longer in the male. Caudal peduncle nearly twice as long as deep. Scales 30–33 in a longitudinal series, 10 or 11 in a transverse series. Yellowish or olive, with magenta-red spots, which are more profusely distributed in the male than in the female and may form longitudinal bands; fins dark, more or less spotted with magenta-red in the male.

Total length 55 millim.

Several specimens from the Kribi River and one from the Ja River.

Specimens from the Kribi River had previously been referred by me to *H. elegans*, Blgr., and have appeared under that erroneous name in the list published in the 'Proceedings of the Zoological Society.'

*Fundulus Loennbergii.*

Depth of body  $4\frac{1}{2}$  times in total length, length of head  $3\frac{2}{3}$  to 4 times. Snout as long as the eye, the diameter of which is  $3\frac{1}{2}$  times in length of head; lower jaw projecting a little beyond upper; interorbital width about  $\frac{1}{2}$  length of head. Dorsal and anal exactly opposed to each other, the former



with 11 or 12, the latter with 12 or 13 rays; dorsal originating a little nearer head than root of caudal, its first ray corresponding to the tenth scale of the lateral line; some of the posterior dorsal rays produced into long filaments. Pectoral about  $\frac{2}{3}$  length of head. Caudal acuminate, median rays produced into filaments. Caudal peduncle nearly twice as long as deep. 27 scales in a longitudinal series, 10 in a transverse series. Yellowish olive, most of the scales with a crimson spot or vertical bar; head with crimson wavy lines; fins dark, all except the pectorals with small crimson spots.

Total length 50 millim.

Two specimens from the Kribi River.

This species is named in honour of Dr. E. Lönnberg, of Upsala, the author of several contributions to the fish-fauna of Cameroon.

*Pelmatochromis longirostris.*

Teeth in 3 series in each jaw, outer largest. Depth of body equal to length of head, 3 times in total length. Snout narrow, obtusely pointed, with slightly convex upper profile, more than one third length of head; diameter of eye  $3\frac{1}{4}$  to 4 times in length of head and equal to or a little greater than interorbital width; maxillary not reaching to below anterior border of eye; 2 or 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, tubercular, notched, 9 or 10 on lower part of anterior arch. Dorsal XIV-XVI 8-9; spines increasing in length to the last, which measures  $\frac{2}{3}$  to  $\frac{1}{2}$  the length of the head; middle soft rays produced, a little shorter than the head. Pectoral  $\frac{2}{3}$  to  $\frac{3}{4}$  length of head. Ventral produced into a filament, reaching origin of anal or beyond. Anal III 6-7, third spine nearly as long as last dorsal. Caudal rounded-subacuminate. Caudal peduncle as long as deep. Scales smooth, with fine concentric striation, 28-30  $\frac{2-2\frac{1}{2}}{8-9}$ ; lat. l.  $\frac{16-21}{8-10}$ . Yellowish or pale brown, the scales edged with darker, or with rather ill-defined dark longitudinal streaks; a more or less distinct dark horizontal streak behind the eye; vertical fins with dark spots forming more or less regular bars; these numerous and usually very regular on the caudal fin; outer rays of ventrals white.

Total length 115 millim.

Seven specimens from the Kribi River.

Most nearly related to *P. Batesii*, Blgr., which has a shorter and broader snout, 4 series of scales on the cheek, a deeper body, more dorsal (10-11) and anal (8) soft rays, and a different coloration.

XLIII.—*North-American Bees, and a new Homopteron.*

By T. D. A. COCKERELL.

## APOIDEA.

*Augochlora confusa coloradensis* (Titus).*Augochlora coloradensis*, Titus, Canad. Entom., May 1901, p. 133.

The difference in the colour of the legs between this and *A. confusa*, mentioned by Titus, does not hold good; but *coloradensis* is uniformly smaller, and seems to be a valid subspecies.

*Hab.* Mesilla Park, N. M., at flowers of *Aster tenaceti-folius*, May 20, 1 ♀ (*Martin D. Cockerell*); Roswell, N. M., Aug. 21, at flowers of *Euphorbia marginata*, both sexes (*T. D. A. Cockerell*).

New to New Mexico. I have confused the Mesilla Valley females with *A. neglectula*, which is a very much bluer species. The male of *neglectula* is very easily known from that of *coloradensis* by the fourth ventral segment of abdomen not being in the least emarginate, the darker and the very long antennæ, and the legs black with metallic tints, not in the least marked with pale yellow. The region between the antennæ and the ocelli in male *neglectula* is a particularly fine deep blue, while the clypeus and supraclypeal area are green. The third and fourth antennal joints (♂) are dull black and extremely short, being broader than long, but they have also this shape in *coloradensis*.

*Andrena mimetica*, sp. n.

♀.— $12\frac{1}{2}$  millim. long.

Head, metathorax, and legs black; abdomen and dorsum of thorax bluish green, exactly the colour commonly seen in *Osmia*; pleura dark blue; pubescence long and erect, black and rather dull white; on face (except at sides above), cheeks, and occiput it is white; on vertex black; facial quadrangle much broader than long; disk of clypeus shining, with strong close punctures, and an impunctate median line; facial foveæ short and black; process of labrum rather narrow, truncate, and strongly emarginate; tongue short; second and third joints of labial palpus triangular, fourth narrow-cylindrical; antennæ entirely black, fourth joint shorter than fifth, third at least as long as fourth and fifth together; mesothorax more or less granular, with strong

rather shallow punctures; metathorax roughened, the triangular enclosure very ill-defined; hair of thorax white, black on scutellum (except sides) and hind part of mesothorax, also black on pleura (except in front) and middle portion of metathorax; hair on legs black, but anterior femora behind, hind femora beneath, and hind tibiæ beneath, each with a large amount of shining silvery-white hair; a little of the same hair springs from the keeled lower edge of the middle femur; spurs dark brown; tegulæ shining black. Wings faintly dusky; nervures and stigma very dark brown, the latter unusually narrow; second submarginal cell nearly square, receiving the first recurrent nervure a little beyond the middle. Abdomen strongly and distinctly punctured, not in the least banded (except to some extent on ventral surface); white hair long and conspicuous on first segment; apical margin of each dorsal segment covered with erect black hair, only noticed on viewing the abdomen laterally; caudal fimbria black; sides of abdomen with shining white hairs.

♂.—Length about  $10\frac{1}{2}$  millim.

Very much more slender; face black, the clypeus tinged with bluish green; hair of face black, long, a little paler below antennæ; antennæ wholly black, crenulated; second submarginal cell higher than long; hind femora decidedly bluish; sides of metathorax with black hair.

*Hab.* Placita, N. M. (near Las Vegas Hot Springs), May 2, 1903, two of each sex (*W. P. Cockerell*).

The females were at flowers of *Salix*, the males at flowers of *Ribes longiflorum*, variety. This splendid species is exactly like an *Osmia* in superficial appearance, and when the specimens were caught I had no idea that the females did not belong to that genus. Similar species of *Osmia* are common in the same region. The only similar species in New Mexico is *A. cerasifolii*, but *A. mimetica* is quite distinct from that and from all described species.

### *Andrena pluvialis*, Ckll.

♂.—Like that of *A. carlini*, but more robust; first joint of flagellum somewhat longer; abdomen with a good deal of black hair, especially beneath; hair on inner side of tibiæ and tarsi sooty with a sort of purplish tint; second submarginal cell much larger.

*Hab.* Placita, N. M., April 25, 1903, both sexes at flowers of wild plum (*W. P. & T. D. A. Cockerell*).

New to New Mexico. Also found at Placita on the same day were *Andrena erythrogaster* (Ashmead), common at

flowers of *Salix*, new to New Mexico; *A. Cressonii*, Rob. (the form *kansensis*, Ckll.); and *Halictus perdifficilis*, Ckll.

*Perdita chamæsarachæ*, Ckll.

*Perdita sexmaculata*, Ckll.

Both these species were taken at Roswell, N. M., Aug. 20, 1902, at flowers of *Chamæsaracha sordida*.

*Epeolus occidentalis*, Cr., ♀.

*Exomalopsis solani*, Ckll., ♀.

These were taken at Mescalero, N. M., Oct. 1 and 2, at flowers of *Bigelovia graveolens glabrata*. The occurrence of the *Exomalopsis* in this locality is rather surprising. *Diadasia diminuta*, Cr., was taken at Mescalero, Oct. 3, at flowers of *Sphaeralcea Fendleri*.

*Megachile cleomis lippicæ*, Ckll., ♂.

Roswell, N. M., Aug. 20, 1902 (Cockerell).

*Nomada modocorum*, sp. n.

♂.—Length about  $9\frac{1}{2}$  millim.

Black and yellow, with red on legs and abdomen. Head transversely oval, vertex broad; face, cheeks, and pleura covered with white hair; hair on top of head and dorsum of thorax ochraceous; clypeus except narrow hind margin, lateral face-marks (broad below, above rapidly narrowing to a line which ends about level with the antennæ), labrum, mandibles except tips, stripe behind lower part of eyes, linear marks on hind border of prothorax, tubercles, and semilunar mark on lower part of pleura, all *lemon-yellow*; no yellow on scutellum or metathorax; mandibles simple; scape swollen, yellow beneath, black above; third antennal joint a little shorter than fourth; flagellum ferruginous, black above on joints 3 to 6, or the first four joints of flagellum proper; mesothorax extremely densely punctured and quite hairy; scutellum inconspicuous; tegulæ testaceous, punctured. Wings nearly clear except the dusky apical margin; stigma ferruginous, nervures fuscous; lower inner angle of second submarginal cell quite acute; transverso-medial nervure joining the discoidal at its base. Legs ferruginous, varied with yellow, coxæ mostly black; hind femora blackened



behind except at apex, middle femora with a black streak behind; hind tibiæ blackened outwardly on basal half; hair on inner side of basal joint of hind tarsi fuscous; abdomen of ordinary shape, minutely roughened, lemon-yellow, with the basal half of the first segment black, and the hind margins of all the segments ferruginous; sixth segment with a black spot at sides, overlapped considerably by fifth; apical plate hairy, ferruginous, notched, but so slightly as to appear at first sight entire; venter yellow varied with ferruginous, the last segment with a conspicuous patch of short white hairs.

*Hab.* Corvallis, Oregon, June (*Cordley*).

Received from Mr. Viereck.

*Nomada Cordleyi*, sp. n.

♂.—Length 7 millim.

Black with yellow markings and ferruginous stains; peculiar for its slender form, very long antennæ, and subclavate abdomen, which, taken with the attitude and appearance of the hind legs, is somewhat suggestive of such flies as *Syritta pipiens*. The hind coxæ are long, and the arched hind femora look as if they proceeded from the abdomen. Face transversely oval, vertex very broad; eyes pale green; clypeus, supraclypeal region, and labrum thickly covered with silver-white hair; mandibles simple; clypeus except two spots on upper border, lateral face-marks (broad below, continued as a line up orbital margin to level of antennæ), labrum, mandibles except tips, line beneath eyes, and broad stripe on scape beneath, lemon-yellow; scape swollen, black except the yellow stripe; third antennal joint extremely short, much shorter than fifth, and less than half the length of fourth, which is much longer than fifth; flagellum extremely long, black above, ferruginous beneath; thorax extremely densely punctured, hairy (the pubescence white), black without any yellow; tubercles and tegulæ largely dark brown. Wings iridescent, fairly clear, dusky on apical margin; second submarginal cell unusually narrow, its side towards the third bulging; transverso-medial nervure joining discoidal a short distance from its base. Legs yellowish ferruginous, the femora and tibiæ (especially the hind ones) more or less black behind; abdomen yellowish ferruginous, with lemon-yellow spots on the sides of the segments; basal half of first segment black, the other segments with broad black bands with suffused edges; hind margins of segments rather dark reddish; apical plate emarginate; venter

yellowish ferruginous, with darker stains. First abdominal segment deeply grooved above.

*Hab.* Corvallis, Oregon, June 3, 1899 (*Cordley*).

Received from Mr. Viereck.

*Nomada placitensis*, sp. n.

♀.—Length about 10 millim.

Head and thorax ferruginous and black, the only yellow being a spot on tubercles and a very little at lower corners of face; legs bright ferruginous, a yellow spot at apex of first four femora above, much black on coxæ, a black spot on first four trochanters behind, a black stripe on anterior femora behind, a black spot at base of middle femora behind, a slight spot on hind femora not so basal, a small black stripe on hind tibiæ behind; abdomen narrow, bright lemon-yellow, base of first segment with a large black spot broadly margined with rufous; apical margin of first segment margined with black, and in front of the black with rufous; base of second segment with a very broad inverted triangle of rufous; apex of second segment broadly rufous; the next two sutures black, more or less broadly margined with rufous; venter pale reddish, suffusedly banded with yellow and black. Mandibles simply rufous except ends; first joint of labial palpi black, a little longer than the other three together; maxillary palpi long, not very much shorter than galea; clypeus (except hind margin), labrum, supraclypeal spot, lateral face-marks running to tops of eyes, posterior orbital margin, antennæ (except stripe on first three joints above), two large confluent spots on scutellum, large ill-defined mark on pleura, obscure band on postscutellum, four obscure narrow bands (the lateral ones marginal) on mesothorax, and tegulæ, all *ferruginous*; pubescence of head and thorax pale fulvous; scutellum with two prominent bosses; mesothorax as densely punctured as is possible; third, fourth, and fifth antennal joints of the same length. Wings dusky, stigma orange-fulvous, nervures pale brown; second and third submarginal cells each receiving the recurrent nervure at its middle; second submarginal cell narrowed above, about as broad as third on marginal nervure; transverso-medial nervure joining discoidal at its base.

*Hab.* Placita, N. M., May 2, 1903, at flowers of wild plum (*Cockerell*).

The abdomen is much like that of *N. civilis*, Cresson. I will take this opportunity to mention that the species recorded by me from Wet Mountain Valley, Colorado, in

Trans. Am. Ent. Soc. 1893, p. 339, as *N. fragilis*, Cresson, is (at least as represented by the single specimen I have kept) *N. civilis*.

*Nomada accepta*, Cresson.

I have this species from Colorado Springs, Colorado (*L. Bruner*, 24). *N. pacata*, Cresson, is a synonym; I determined this from the descriptions, and Mr. Viereck has confirmed it by a comparison of Cresson's types.

*Melissodes humilior*, sp. n.

♀.—Length hardly 10 millim.

Black with pale pubescence, white on the underparts of head and thorax, stained with pale ochreous on the upper parts, black on scutellum and hind part of mesothorax; a few black hairs on sides of vertex, which is broad and shining; facial quadrangle broader than long; clypeus confluent punctured; eyes pale grey; flagellum ferruginous beneath, except the first two joints; tegulæ piceous. Wings only faintly dusky, not darkened apically; nervures dark brown; third submarginal cell abruptly truncate. Legs clothed with white or whitish hair, the scopa on hind legs very large and dense; hair on outer side of anterior tarsi very dark purplish fuscous, in strong contrast with the white hair on outer side of middle tarsi; hair on inner side of tarsi dark shining ferruginous. Abdomen broad, the base and sides of first segment with white hair; the second to fourth segments with broad bands (especially broad on fourth) of appressed white hair; base of second segment with some white hair; basal part of third and fourth segments covered with velvety-black pile; apical segments with black hair. In my table in Bull. Denison Lab. xi., this runs to *M. gilensis*, but it is considerably smaller, the abdominal bands are white instead of yellowish, and there are other differences.

*Hab.* Organ, New Mexico, Sept. 28, alt. 5100 feet (*Cockrell*).

Another example, taken by Prof. C. H. T. Townsend at Las Cruces, N. M., Aug. 19, differs by having the second submarginal cell larger, the hair on the anterior part of the mesothorax quite strongly fulvous, the vertex covered with black hair, and the hind tarsi red, as also the small joints of the middle tarsi. The wings have a milky iridescence. This form may be known as var. *α*.

The species recorded from the Mesilla Valley, N. M., as *M. intermedia*, Cresson (having been identified by Mr. Fox),

is extremely similar to *M. humilior*, but differs in having the hair on the inner side of the basal joint of the hind tarsi black or almost so. Both this insect and *humilior* have the two apical segments of the abdomen clothed with sooty hairs, whereas Cresson says that the hair on these segments in *intermedia* is pale. In both the New Mexico insects, also, the apical plate is triangular and bluntly pointed, I think not so broadly rounded as it should be in *intermedia*. These bees have an extremely close resemblance to certain species of *Synhalonia*, but their mouth-parts are those of *Melissodes*. The maxillary palpi of *Melissodes* are always said to be 4-jointed; but as a matter of fact the fourth joint usually bears a distinct rounded or cylindrical apical papilla, from which grows a single stout bristle; this papilla is evidently the rudimentary fifth joint. In *M. humilior* the papilla is unusually long, so that it really looks like a sort of small fifth joint; but the fourth joint broadens towards its base, and is not differentiated by a distinct suture from the third, which is quite stout. In *M. intermedia* (i. e. the New Mexico insect so named) the third joint is narrower, and is separated by a very distinct suture from the fourth, which is not at all broadened basally; the apical papilla is minute and inconspicuous.

No doubt *Synhalonia* is a more primitive type than *Melissodes*, but between the two stands *Xenoglossodes*, with distinctly 5-jointed maxillary palpi. The fourth joint in *Xenoglossodes* is much larger than the fifth, which would only need to be moderately reduced to reach the exact condition found in some *Melissodes*. Thus we have evidence of the gradual reduction of the fifth joint; it by no means disappeared suddenly by De Vriesian mutation!

I will now describe a species which has the palpi of *Xenoglossodes*, but altogether the external appearance of *Melissodes* or *Synhalonia*; in fact, it is so like *M. humilior* that at first sight I took it to be the same. It cannot go in *Florilegus*, which also has 5-jointed maxillary palpi, as the joints are not moniliform, and the general appearance of the bee is not at all the same.

*Xenoglossodes excurrents*, sp. n.

♀.—Length about 10 millim.

Broad, similar to *Melissodes humilior*, but antennæ a trifle longer, the last joint longer than the penultimate (in *humilior* they are equal); pubescence of thoracic dorsum pale ochraceous, without any black; hair on inner side of basal joint of hind



tarsi fuscous; abdominal bands broader and more ochraceous. Flagellum red beneath, except basally; wings rather short, hyaline; tegulae piceous, very hairy; last two abdominal segments fringed with purplish-black hair. Easily known from other species of *Xenoglossodes* by the banded abdomen. Maxillary palpi with the second joint hardly so long as the third; fourth strictly cylindrical, hardly or not half length of third; fifth minute but very distinct, cylindrical, about or hardly half length of fourth, bearing a bristle at the end.

*Hab.* Roswell, N. M., Aug. 20, 1902 (*Cockerell*).

The following table will give some idea of the modifications in the mouth-parts of the Eucerini:—

Maxillary palpi 6-jointed; last joint long and narrow .....	1.	
Maxillary palpi 5-jointed; last joint distinct .....	2.	
Maxillary palpi 4-jointed, with a terminal papilla representing the fifth usually visible .....	7.	
1. Joint 6 much narrower than 5 .....		<i>Synhalonia atriventris</i> , Sm.
Joint 6 scarcely narrower and almost as long as 5, but 5 conspicuously narrower than 4 .....		<i>S. crenulaticornis</i> , Ckll.
2. Maxillary palpi comparatively long and slender; joint 5 always well developed, cylindrical. (= <i>Xenoglossa</i> .)	3.	
Maxillary palpi shorter, fifth joint smaller, sometimes very small. (= <i>Xenoglossodes</i> .) .....	5.	
3. Joint 5 conspicuously shorter than 4 ..	4.	
Joint 5 long and narrow, nearly as long as 4; 4 narrower but not much shorter than 3 .....		<i>X. fulva</i> , Sm., and <i>X. patricia</i> , Ckll.
4. Joint 4 about as long as 3; 5 long and narrow .....		<i>X. strenua</i> , Cr.
Joint 4 much shorter than 3; 5 not very long and narrow; palpus hairy..		<i>X. pruinosa</i> , Say.
5. Joint 2 considerably longer than 3; 5 very small, conical .....		<i>X. albata</i> , Cr.
Joint 2 shorter or not longer than 3 ..	6.	
6. Joint 5 long-conical .....		<i>X. eriocarpi</i> , Ckll.
Joint 5 cylindrical .....		<i>X. excurrens</i> , Ckll., and <i>X. imitatrix</i> , Ckll. & Porter.
7. Last joint long and cylindrical (possibly = 4 and 5 fused), not very much shorter than 3; apex with two bristles; no distinct papilla .....		<i>Melissodes luteicornis</i> , Ckll.
Last joint much shorter than third. . .	8.	
8. Last joint comparatively large, cylindrical, more or less tapering apically .		<i>M. menuacha</i> , Cr., <i>M. bimaculata</i> , Lep., and <i>M. pallidicincta</i> , Ckll.

- Last joint small but robust, truncate,  
 with apical tubercle evident ..... *M. ruidosensis*, Ckll.,  
*M. agilis aurigenia*, Cr., and *M. intermedia*, Cr., Fox.  
 Last joint small, tapering ..... 9.  
 9. Palpus robust, very bristly ..... *M. grindeliæ*, Ckll.  
 Palpus not so bristly; apical tubercle  
 unusually long ..... *M. humilior*, Ckll.

*Melissodes luteicornis* falls in a new subgenus, which I propose to call *Martinella*, after my little son. Besides the characters of the palpi, it is distinguished by its yellow antennæ in the male, and strongly banded abdomen. I am myself confident that it was derived from some *Synhalonia*-like form quite independently of the rest of the genus *Melissodes*; if this can be proved, *Martinella* will, of course, rank as a genus.

#### DASIAPIS, gen. nov.

Belongs to the Anthophorini. Similar to *Diadasia*, but clypeus and labrum in male white; middle and hind tibiæ of male incrassate; tarsi of male normal, except that first joint of hind tarsi is somewhat curved; maxillary palpi with six long cylindrical joints, the third and fourth without the lateral brushes of hair seen in *Diadasia* \*.

#### *Dasiapis ochracea*, sp. n.

♂.—Length about 10 millim.

Covered all over (except the smooth shining vertex) with light ochraceous pubescence; facial quadrangle much longer than broad, narrowed below; face densely covered with hair; clypeus, labrum, and basal part of mandibles white; mandibles simple; antennæ very short (as in *Diadasia*), flagellum ferruginous beneath; scape slender, black; mesothorax dull; tegulæ large, ferruginous. Wings faintly dusky; stigma rather large, ferruginous; nervures fuscous; venation as in *Diadasia*; second submarginal cell narrowed above; third rounded (not truncate) at end; basal nervure meeting transverso-medial. Legs with long coarse hair; tarsi ferruginous; abdomen rather long and narrow, shining but covered with appressed ochraceous hair; first segment with no transverse keel; venter shining, with apical hair-bands on the segments.

*Hab.* Las Cruces, N. M. (type locality), end of August, at

\* The same brushes occur in *Entechnia* on the second and third joints, but these are no doubt morphologically the third and fourth, the long first joint representing two united.

flowers of *Sphæralcea Fendleri lobata*. Also found at Santa Fé, August 17th.

*Dasiapis ochracea* is common in New Mexico, but has been confused with *Diadasia enavata*, Cr. It is to *Diadasia* somewhat as *Anthophorula* is to *Exomalopsis*. The longer abdomen will readily separate the genus from *Anthophorula*, and the paraglossæ show that it belongs to the Anthophorini. The form of the galea and the maxillary palpi show that the genus is near to *Diadasia*, and quite distinct from *Anthophora*.

The galea in *Dasiapis ochracea* is broad at the base, but rapidly tapers to a long narrow apical portion. The maxillary palpi are more than half the length of the galea; the first four joints are long and subequal, the first being a little shorter than the second; the fifth is considerably shorter than the fourth, perhaps by one third, and the sixth is considerably the shortest. The third joint of the labial palpi is attached a short distance from the tip of the second.

*Anthophora euops*, sp. n.

♂.—Length 15 millim.; tongue about  $11\frac{1}{2}$ .

Black, with white and black pubescence; eyes in life deep sea-green; labrum (except narrow black margin and two large brownish spots at posterior corners), clypeus (except lateral margins very broadly, so that the yellow on its upper part is a mere band), a narrow supraclypeal stripe, rose-thorn-shaped lateral marks, and broad stripe on scape, all primrose-yellow; mandibles slender, entirely black, furnished within near tip with a large keel-like prominence; flagellum entirely black; clypeus nude; hair of face, occiput, and cheeks long and white, some black hair on vertex; hair of thorax long and white; mesothorax and scutellum dull, minutely malleate-granular, almost entirely without hair (at least in the specimen described); tegulæ large, black. Wings slightly dusky. Legs with long white hair; inner side of tarsi with orange-fulvous hair; hind legs simple; middle tarsi rufous except at base and apex, the rufous portion with a quantity of ferruginous hair, the hairs curiously flattened and broadened; apical half of claw-joint broadened, black, fringed laterally with black hair; middle and hind femora and tibiæ with long black hairs beneath. Abdomen not banded; first two segments with erect white hairs, the remaining segments with black hair, the sixth fringed with white; venter with long white hairs.

*Hab.* Placita, N. M., May 2, 1903 (*T. D. A. & W. P. Cockerell*).

It was industriously visiting the flowers of *Ribes longiflorum*, variety, and occasionally going to the flowers of wild plum immediately adjacent. Allied to *A. Porteræ*, Ckll., *A. lesquerellæ*, Ckll., *A. Crotchii*, Cr., and *A. pyralitarsis*, Dours. It is easily distinguished from *Porteræ* by the large amount of black on clypeus, the squarer labrum, and especially the flattened red hairs on middle tarsi; from *lesquerellæ* by the nude clypeus and labrum, the smaller black fringe on claw-joint of middle tarsi, &c.; from *Crotchii* by the pale (instead of pale yellow) face-marks, the absence of ochreous hair on head and thorax, &c.; from *pyralitarsis* by the absence of any reddish hair at base of abdomen and the absence of black hair on first joint of middle tarsi. The clypeus is marked much as in *A. pyralitarsis*.

#### HOLCOPASITES, Ashmead.

Mr. Ashmead has very kindly allowed me to examine the undescribed type of this genus, which was taken by Mr. F. C. Pratt at Washington, D.C. It is a female, and is very like *Neopasites pulchellus* (*Phileremus pulchellus*, Cr.), but the marginal cell is shorter and appendiculate, and the second submarginal is more narrowed above. I am rather disinclined to consider *Holcopasites* distinct from *Neopasites*.

#### *Cælioxys grindeliæ*, Ckll., var. $\alpha$ .

♀. Hair on face and lateral spots on mesothorax white; tegulæ dark brown.

*Hab.* Mescalero, N. M., Oct. 2 (*Townsend & Cockerell*).

#### *Cælioxys rufitarsus rhois*, subsp. n.

♀.—Length  $14\frac{1}{2}$  millim.

Tegulæ and nervures black.

*Hab.* Rio Ruidoso, White Mts., N. M., about 6500 ft., at flowers of *Rhus glabra*, July 22 (*C. H. T. Townsend*).

For an account of other specimens and other particulars, see 'Canadian Entomologist,' 1900, p. 298.

#### *Osmia Kincaidii*, Ckll.

Alum Rock Park, San José, California, 1 ♂ (*E. M. Ehrhorn*).

Mr. Ehrhorn also sends me *Bombus californicus*, Sm., from the same locality.

#### *Xylocopa orpifex*, Sm.

Mountain View, California, June 1902, 5 ♂ (*E. M. Ehrhorn*).



Mr. Ehrhorn also sends *Synhalonia acerba*, Cr., ♂, from this locality.

*Ceratina neomexicana*, Ckll.

A new locality is Rio Ruidoso, N. M., about 7600 ft., at flowers of *Verbena Macdougalii*, Aug. 3 (C. H. T. Townsend).

*Ceratina submaritima Ehrhorni*, subsp. n.

♂.—Length 4 millim.

Yellowish green (*submaritima* is bluish green); face decidedly narrower than in *submaritima*. Hind femora produced to an acute angle. Apical plate of abdomen small and narrow as in *submaritima*. Very likely a distinct species; probably confused with *C. tejonensis*.

*Hab.* Alum Rock Park, San José, California, May 3, 1902, 2 ♂ (*E. M. Ehrhorn*).

*Ceratina Townsendi*, sp. n.

♀.—Length 8 millim.

Similar to *C. neomexicana*, Ckll., but differing by the yellower tint of the green, the darker wings, the smaller and closer punctures of the abdomen, and the closer and more uniform punctuation of the scutellum. It has been confused with *C. dupla*, Say, from which it differs by the much sparser punctuation of the vertex and front, the more pronounced rim of the metathoracic enclosure, and the darker wings. From *C. Crewi*, Ckll., it differs by its brassy-green colour, and especially by the sparser punctuation of the vertex on each side of the ocelli, this region in *Crewi* being very closely and coarsely punctured.

*Hab.* San Rafael, Rio Nautla, Vera Cruz, Mexico, on flowers of *Bidens* and *Verbesina*, March 8 to 19, 9 ♀ (*C. H. T. Townsend*).

**Tettigoniidæ.**

*Oncometopia undata garryæ*, subsp. n.

♂.—Length 11 millim. (to tips of closed elytra).

Light ground-colour (*i. e.* all except the black) of head, thorax, and sides of abdomen lilac, except that the black markings are mostly narrowly edged with dull white, and the lateral spots on the scutellum are orange-vermilion; the reversed **A** in black on the vertex is very distinct, and its

upper part encloses a triangular space which is emarginate behind and produced and much narrowed in front; from the emargination runs a light line dividing the space longitudinally; the lower (posterior) ends of the **A** enclose the lateral ocelli; the scutellum presents on a black field two median rather short bars, a large apical subreniform spot, two small lateral spots, and anterior to these two rather large oblong marks, of these markings the last mentioned being orange-vermilion and the others lilac; underside of abdomen lilac, with black at the bases of the segments; elytra green in life, but in a dry specimen purplish grey by reflected and deep rose-pink by transmitted light; the costa very narrowly dull orange; a large, very irregular, pale green patch next to the costa about the middle of the elytron, and touching it anteriorly a short black bar; apical field smoky hyaline bordered with black, the black next to the purple-grey rather broadly edged on the inner side with chrome-yellow. Plates of ♂ genitalia somewhat longer than in Ball's figure of typical *undata*.

*Hab.* Dripping Spring, Organ Mts., N. M., frequent on *Garrya Wrightii*.

I could not find any, or any other form of *O. undata*, on other plants in the Organ Mts., and I believe the insect is restricted to the *Garrya*, with which its colours harmonize well. Mr. O. Heidemann kindly examined a specimen, and considered it near *O. alpha*, Fowler, which Mr. Ball considers a mere form of *O. undata*. I suspect that we should understand better the many varieties or subspecies of *O. undata* if in every case we knew the food-plant.

East Las Vegas, New Mexico, U.S.A.,  
May 8, 1903.

#### POSTSCRIPT.

##### *Another new Anthophora.*

Much to my surprise a second new *Anthophora* has been caught in this vicinity this spring.

##### *Anthophora Gohrmannæ*, sp. n.

♂.—Length 12 millim.

Black; the abdomen with a slight bluish lustre, the hind margins of the segments narrowly brown; tongue comparatively short, about 6 millim. long; two apical joints of maxillary palpi very small; mandibles black; eyes deep olive-

green ; facial quadrangle a little longer than wide, the inner orbits convex ; labrum (except very narrow margin and two large spots at basal corners), clypeus (except very narrow anterior edge and a long black mark on each lateral margin), supraclypeal band, rose-thorn-shaped lateral face-marks, and broad stripe on scape, all very pale yellow ; hair of head, thorax, legs, and first two abdominal segments abundant, long, erect, and white, *with no black hairs intermixed* ; flagellum entirely black ; third antennal joint long and narrow, suddenly enlarging, trumpet-like, at the apex ; thorax dull, densely rugoso-punctate ; tegulæ black. Wings clear, nervures black or almost so. Legs black, even to the tarsi ; hair on inner side of tarsi shining coppery red when seen in the proper light ; middle tarsi long and slender, twice as long as their tibiæ, but not otherwise peculiar ; spurs very long ; *basal joint of hind tarsi with a prominent oblique tooth on the anterior margin* ; abdominal segments 3 to 5 with erect black hair, and some light hairs intermixed ; sixth with light hair, not conspicuous ; *no hair-bands* ; apical dorsal segment with short appressed silvery hair, narrowly truncate, with lateral margins showing a strong double curve ; claspers very large, deeply bifid or bidentate, the posterior margin obtusely angled, the base of each posterior tooth emitting a long cylindrical light brown fleshy organ, beset with short hairs ; ventral surface of abdomen with long white hair.

*Hab.* Las Vegas, N. M., May 7, 1903 (*Anna Gohrman*). Flying around *Ribes longiflorum* (along with *A. Porteri*), but the tongue seems too short to suck from that flower. It is allied to *A. Edwardsii*, Cresson.

XLIV.—*Notes on South-American Monkeys, Bats, Carnivores, and Rodents, with Descriptions of new Species.* By  
OLDFIELD THOMAS.

### *The Generic Names Callithrix and Hapale.*

THE common laxity about nomenclature is nowhere more striking than among the Primates, and an instance of this occurs in connexion with the genera of Cebidæ usually termed *Callithrix* and *Hapale*, the Titi Monkeys and Marmosets.

Fine paper as it was, Geoffroy's 1812 monograph of the

monkeys\* has had an unfortunate effect so far as nomenclature is concerned owing to its very excellence, for later authors have accepted his names, new or old, without enquiry, with results that now prove to need much revision.

Firstly, *Callithrix*, quoted quite commonly as from this paper, and consequently used for the Titis, was really first founded in 1777 by Erxleben, who included in it six monkeys, no one of which was a Titi; and it is therefore quite evident that some other name must be used for this group. Thanks to the labours of Lesson, Gray, and others, names are numerous among South-American monkeys, but, curiously enough, I can find none that has ever been applied to the Titis except this untenable *Callithrix* and the misapplied "*Saguinus*, Lacépède," of Lesson, whose real basis was the common marmoset.

The Titi Monkeys will therefore need a new name, and *Callicebus* may be suggested for them, with *C. personatus*, Geoff., as the type species.

Passing to the Marmosets, we find that authors have been contented to use Illiger's *Hapale* of 1811 for them, ignoring the fact that no less than three earlier names exist, namely: *Callithrix*, Erxleben, 1777; *Sagoinus*, Kerr, 1792; and *Sagouin*, Lacépède, 1799.

*Callithrix*, Erxleben, contains six species—*C. pithecia* and five Marmosets. The first-named of these was made the type of the genus *Pithecia* by Geoffroy in 1812, now therefore *Pithecia pithecia*, leaving the type to be found among the Marmosets. Fortunately this can be definitely fixed by the quotation of "*Callithrix*" as the first synonym of *Callithrix jacchus*, this species having therefore to be taken as the type under the rule recently published on the subject in 'Science'†.

In the splitting of the Marmosets into two genera this allocation of the type is fortunate, for it makes *Jacchus*, Geoff. (type *C. jacchus*), a pure synonym of *Callithrix*, and leaves *Midas*, Geoff. (type *M. midas*), available for the "Tamarins," the Marmosets with long typically-formed lower canines and small incisors, the group to which the name has usually been applied.

*Sagoinus*, Kerr, 1792, containing exactly the same species as Erxleben's *Callithrix*, becomes a full synonym of it, and cannot be used for any part of the group. The name being

\* "Tableau des Quadrumanes," Ann. Mus. xix. p. 85 (1812).

† 'Science,' xvi. p. 114 (1902).



based on *Sagouin*, a quoted synonym of *C. jacchus*, also indicates that species as its type.

*Sagouin*, Lacépède, had as its only species *Sagouin jacchus*, the type species of *Callithrix*, into whose synonymy it will therefore fall.

*Hapale*, Illiger, 1811, being put as a classical renaming of "*Saguinus*, Cuvier, Duméril, Lacépède," will equally have *C. jacchus* as its type.

These conclusions may be tabulated as follows:—

### 1. Titi Monkeys.

#### CALLICEBUS, nom. nov.

*Callithrix*, Geoff. Ann. Mus. xix. p. 112 (1812), et auctorum plurimorum (nec Erxleben, 1777).

"*Saguinus*, Lac.," Lesson, Man. Mamm. p. 56 (1827) (nec *Sagouin*, Lac. 1799, nec "*Saguinus*, Lac.," Illiger, 1811).

Type *C. personatus*, Geoff.

### 2. True Marmosets.

#### CALLITHRIX, Erxl.

*Callithrix*, Erxl. Syst. R. A. p. 55 (1777).

*Sagouin*, Kerr, Linn. An. K. p. 80 (1792).

*Sagouin*, Lacépède, Tabl. Mamm. (1799).

*Hapale*, Ill. Prodr. Syst., Mamm. p. 71 (1811).

*Jacchus*, E. Geoff. t. c. p. 118 (1812).

Type of all these names *C. jacchus*, Linn.

### 3. Tamarins.

#### MIDAS, Geoff.

*Midas*, Geoff. t. c. p. 120 (1812).

Type *M. midas*, Linn.

The family name for the Marmosets will be Callitrichidæ.

#### *Anthorhina picata*, sp. n.

General characters of *A. longifolium*, Wagn., with which it shares the comparatively uncrenulated state of the edges of the lancet and other structural details, as described by Wagner and Peters. Margins of the long lancet and anterior edges of ears prominently hairy. Wings to the base of the metatarsus. Calcars shorter than in *A. longifolium*.

Fur long, strictly limited to the body, except on the wing-membrane between the humerus and the flanks below; hairs of back about 8 millim. in length. General colour above very dark brown, something like "seal-brown" of Ridgway, but darker; extreme bases of hairs whitish; a prominent whitish dorsal streak running from the forehead to the root of the tail. Hairs on the bases of ears behind broadly and prominently white, so as to form a large showy white patch on each side of the crown. Sides of muzzle brown. Under surface and a line running up each side from the angle of the jaws to the hinder edge of the ears dirty yellowish white, the hairs dull slaty with yellowish tips.

Outer upper incisors and small anterior premolars subequal, the latter standing fairly in the tooth-row, not crowded out of it by the approximation behind them of the canine and large premolar, as is the case in *A. crenulata*.

Dimensions of the type (the measurements put in inverted commas taken in the flesh by the collector, the others on the dried skin):—

Forearm 48 millim.

"Head and body 65"; "tail 22"; "ear 27"; noseleaf (dried) 15; tragus on inner edge 8; third finger, metacarpal 47, first phalanx 14, second phalanx 25·5; fifth finger, metacarpal 47, first phalanx 11, second phalanx 11; tibia 22·5; lower leg and foot (s. u.) 31; calcar 22. "Expanse 380."

Skull: greatest length 21·3; basal length 17; zygomatic breadth 12·6; constriction 4; mastoid breadth 12·2; front of canine to back of  $m^3$  8.

*Hab.* Lamarão, Bahia. Alt. 300 m.

*Type.* Adult male. Original number 1410. Collected 24th May, 1903, by Alphonse Robert.

This remarkable particoloured bat is evidently closely allied to the *A. longifolium* of Matto Grosso, but differs by the showy white ear-patches, the white (not "schmutzig grünlichgrau") dorsal streak, and the absence of any "rostgelb" colour on the throat and neck.

### LONCHOPHYLLA, gen. nov. (*Glossophaginæ*).

Interfemoral membrane large, the well-developed tail not reaching halfway to its edge in the middle line, terminating on its upper surface.

Skull elongate, with small brain-case, though not disproportionally so; zygomata undeveloped; pterygoids normal;

palate not unduly elongate, no notches present on the outer sides of its posterior portion.

Dentition :—

$$I. \frac{2}{2}, C. \frac{1}{1}, P. \frac{2}{3}, M. \frac{3}{3} \times 2 = 34.$$

Inner upper incisors conspicuously larger and longer than the outer ones, much thrown forward, broadly spatulate, close together, outer ones small, pointed, conical. Upper premolars and molars about as in *Glossophaga*, though markedly longer horizontally; last premolar with a well-defined internal lobe. Lower incisors not deciduous, more or less overlapping one another, broad, with sharp indistinctly trifid edges. Lower cheek-teeth long and narrow, not overlapping, with small gaps between the premolars.

Type *L. mordax*, sp. n.

This genus is no doubt nearly allied to *Glossophaga*, but may be distinguished by the absence of the zygomata and the unusual size and projection of the median upper incisors. From the development of these teeth and the size and persistence of the lower incisors it is evident that the tongue is less predominant at the expense of the incisors than is the case in the more specialized members of the group.

### *Lonchophylla mordax*, sp. n.

General external appearance, so far as can be judged by skins, exactly as in *Glossophaga soricina*, except that the colour averages paler. The type is near "cinnamon-brown" above, the bases of the hairs whitish, and "wood-brown" below, but there is some variation in tone, and the darker specimens are quite as dark as the paler examples of *Glossophaga* obtained at the same place.

Chin apparently without the usual deep central groove, but as all the specimens are skins, with the skulls extracted, this point is not exactly determinable.

Ears rather more decidedly concave in the upper half of their outer margins than in *Glossophaga*. Noseleaf longer, the upper part of the lancet more sharply triangular, its sides evenly slanted, not concave. Proportions of limb-bones as shown by the measurements below. Size (apart from the very different length of head) and other characters as in *Glossophaga*.

Dimensions of the type (the measurements in inverted

commas taken by the collector in the flesh, the others from the dried skin):—

Forearm 34 millim. (all the specimens about the same).

"Head and body 55"; "tail 8"; "ear 13"; lancet, measured behind (dried) 4·8; thumb (c. u.) 9; third finger, metacarpal 31, first phalanx 11·3, second phalanx 16·5; fifth finger, metacarpal 29, first phalanx 8·5, second phalanx 11; lower leg and hind foot (s. u.) 23; calcar 7·5. "Expanse 265."

Skull: greatest length 23·7; basal length 20·2; anterior breadth opposite  $m^1$  4·8; brain-case, breadth 9·5; palate length 12·8. Front of canine to back of  $m^1$  8·1; front of lower canine to back of  $m_3$  8·7.

*Hab.* Lamarão, N.W. of Bahia. Alt. 300 m.

*Type.* Male. Original number 1552. Collected 3rd July, 1903, by Alphonse Robert. Eight specimens.

*Canis thous angulensis*, subsp. n.

A small form of the *C. thous*\* group, with short stoutly built skull, small flesh-tooth, and pale-coloured limbs.

Size smaller than in true *C. thous* or its Brazilian representative *C. t. melampus*†. General colour much as in the latter, but even more strongly suffused with fulvous. Hairs of dorsal area elongated, annulated with black and white, and with broad black tips; hairs of sides similar but shorter. Underfur dull buffy, becoming ochraceous buff on the prominent postauricular patches. Under surface dirty buffy. Snout not blackened, scarcely darker than the forehead. Back of ears dark ochraceous buff, without blacker patches. Upper surface of hands and feet dull ochraceous buffy, with scarcely a trace of darker marking; below, the palms and soles are inconspicuously blackened. Tail bushy, coloured above like the dorsal area, below like the belly, its terminal hairs broadly black.

Skull very stoutly built, conspicuously shorter than in either *thous* or *melampus*. Forehead not markedly convex, the frontal region far flatter than in the allied forms. Palate

\* *Canis thous*, Linn. Syst. Nat. (12) i. p. 60 (1766).

*C. cancrivorus*, Desm. Mamm. i. p. 199 (1820).

*C. rudis*, Günth. Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 400 (1879).

Type localities: Dutch, French, and British Guianas respectively.

† Wagn. Arch. f. Nat. 1843, p. 357.

*C. brasiliensis*, Lund, nec Cuv.

*C. melanostomus*, Wagn. l. c.



ending opposite the middle of  $m^2$ . Bullæ not particularly high.

Teeth small throughout, as shown by the measurements, the carnassials particularly small, smaller than in any other member of the group.

Dimensions of the type (measured in the flesh):—

Head and body 630 millim.; tail 310; hind foot (s. u). 122; ear 68.

Skull: greatest length in middle line 126; basal length 117; zygomatic breadth 73.5; nasals (from bottom of concavity in front) 41.5 × 11.2; interorbital breadth 28.5; across post-orbital process 40; intertemporal breadth 31.5; breadth of brain-case 45.5; palate, length 62, breadth across  $m^1$  39.2; horizontal length of  $p^4$  (outside) 11, of  $m^1$  and  $m^2$  combined 14.8, of  $m_1$  13.4, of  $m_2$  7.3, of  $m_3$  4.2.

*Hab.* San Lourenço, near Pernambuco.

*Type.* Adult male. Original number 1654. Collected 6th August, 1903, by Alphonse Robert. Three specimens.

This little dog may be readily distinguished from its allies by its small size, pale ears and feet, stout flat-fronted skull, and unusually small carnassials. In its cranial characters no approximation is shown towards it by the small delicately built Savannah race of *C. thous* described by me in 1901\*; but, on the other hand, among examples of *C. t. melampus* from Lamarão, Bahia, one shows such resemblance to it as to render advisable its description as subspecies rather than species.

Mr. Robert has been very successful in obtaining specimens of the present group of Canidæ, having sent home examples from Matto Grosso, Minas Geraes, São Paulo, Espírito Santo, and Bahia, and has been deservedly rewarded by the discovery of this distinct new race inhabiting the eastern angle of South America.

There appears to be no reason why Linnæus's name *C. thous* should have been always ignored in favour of Desmarest's *C. cancrivorus*, both coming from the same region. The large and widely distributed black-footed Brazilian form ought apparently to bear Wagner's appropriate name of *C. t. melampus*.

#### *Conepatus Huntii*, sp. n.

Most nearly allied to *C. arequipæ*, Thos., with which it shares the considerable breadth of the white stripes and their

\* *C. thous savannarum*. Described as *C. cancrivorus savannarium*, Ann. & Mag. Nat. Hist. (7) viii. p. 146 (1901).

termination on the loins. But anteriorly, instead of the median black stripe running forward, as is usual, to within half an inch of the black of the head, it ends on the withers 4 inches short of the coronal black, the whole breadth of the nape being therefore white, except for a minute and probably inconstant black spot halfway down the neck. Black of forehead liberally mixed with isolated white hairs. Tail almost entirely black; some isolated long white hairs on its middle third; the end wholly black.

Fur long, as usual in the highland species. Hairs from the coronal ridge to the isolated black spot directed forwards, those of the next two inches backwards; then those of the anterior inch of the median black stripe forwards, from a median radiating centre, behind which again all are directed backwards.

Skull rather shorter and broader than in *C. arequipæ*.

Approximate dimensions of the type (measured on the skin):—

Head and body (c.) 400 millim.; tail 250; hind foot, s. u. 62, c. u. 69.

Skull: greatest length 77; basal length 66; zygomatic breadth 47; postorbital constriction 20·5; mastoid breadth 40; palate length 32.

*Hab.* Caylloma, Peru. Altitude 4500 m.

*Type.* Female. B.M. no. 3.8.4.1. Original number 30. Collected 18th January, 1903, and presented by Mr. Bernard Hunt.

“Shot crossing the pampa, with four or five others, about midday.”—*B. H.*

This skunk is in some respects a link between *C. arequipæ* and *C. rex*, but differs from both, as from all the other allied species, by its white nuchal region. I have named it in honour of its donor, to whom the National Museum is indebted for many excellent skins of Caylloma mammals.

### *Galictis andina*, sp. n.

A member of the *G. Allamandi* group.

Size and general pattern of coloration as in *G. Allamandi*, but wherever in that animal the colour is white, notably on the light horizontal line bordering the black of the face and throat, in *G. andina* it is a dull buffy. Tips of dorsal hairs whitish buffy. Underfur of back and tail stronger buffy. The net result is that the whole animal has the buffy or

yellowish suffusion characteristic of *G. vittata*, rather than the clear greyish of *G. Allamandi*.

Skull about as in *G. Allamandi*, smaller than in the large Brazilian form described by Nehring as *G. crassidens*. Nasals evenly narrowing backward and pointed behind, not abruptly narrowing from a broad point at about two thirds their length, as in the Central-American form. Last upper molar with a posteriorly broadened inner lobe, almost as in the Martens (*Mustela*), and in this respect quite unlike that of any other *Galictis*.

Dimensions of the type:—

Head and body 540 millim.; tail 160; hind foot, s. u. 75, c. u. 78.

Skull: greatest length 85; basilar length 76; greatest breadth 49; interorbital breadth 19; mastoid breadth 46; palate length from gnathion 41. Teeth: upper incisor-row 11; outer length of  $p^4$  9.5; transverse length of  $m^1$  7.8; longitudinal diameter of inner lobe of  $m^1$  5.1; length of  $m_1$  10.

*Hab.* Pozuzo, Peru.

*Type.* B.M. no. 3. 7. 14. 1. Collected 26th February, 1903, by W. Hoffmanns. Sexed as a male by collector.

This *Galictis* differs both in colour and tooth-structure from the other members of the group. Its yellower colour is markedly different from that of two examples from Chiriqui (*Watson*) which I assign to *G. Allamandi*, and think also represent Nelson's *G. canaster*. Nehring's *G. crassidens*, on the other hand, appears to be a larger animal, as is shown by the greater dimensions of the teeth, and comes from a very different locality. Finally, the broadened inner lobe to the upper molar is quite unique in this genus and recalls the corresponding tooth in *Galera*.

### *Sciurus Roberti*, sp. n.

An olive species related to *S. Ingrami* and *gilvicularis*.

Size, as gauged by linear measures, almost equal to that of *S. Ingrami*, but the animal is more lightly built, and the hands and feet in particular are markedly more slender. Fur throughout much shorter than in *Ingrami*, more as in *gilvicularis* (hairs of back only 6–7 millim. in length), that of ears, feet, and tail all shortened, in agreement with that of the body. General colour above olivaceous, varying from yellowish olivaceous to greyish. Under surface not sharply defined, white or whitish on the throat, inner sides of limbs,

and belly, creamy buff varying to buffy white on the chest. Ears short-haired, without trace of fringes, their backs slightly more fulvous than the general colour. Upper surface of hands and feet generally becoming more fulvous terminally. Tail comparatively narrow, its breadth across the outstretched hairs not or scarcely exceeding 2 inches, its colour blackish washed with white, the two basal light rings of the hairs fulvous, but these are quite hidden by the broad black subterminal and white terminal bands; below they show more, so that the colour is there grizzled fulvous mesially, edged sublaterally with black and laterally with white. Mammaræ 8.

Dimensions of the type (measured in the flesh):—

Head and body 175 millim.; tail 172; hind foot, s. u. 44, c. u. 47.5; ear 20.

Skull: greatest length 46 millim.

Hab. S. Lourenço, near Pernambuco. Alt. 50 m.

Type. Adult male. Original number 1613. Collected 29th July, 1903, by Alphonse Robert. Twelve specimens.

This squirrel evidently represents in the north-eastern corner of South America the *S. Ingrami* of Southern Brazil, of which Mr. Robert has collected a large series at localities ranging from Espirito Santo to Paraná.

In its general proportions it approaches the Amazonian *S. gilvularis*, but differs from that and agrees with *S. Ingrami* by the much paler colour of its under surface. From *S. Ingrami* in turn it may be distinguished by its shorter fur, unfringed ears, less bushy tail, the whiter instead of buffy colour of the inner sides of its limbs, and the white instead of yellow tipping to the caudal hairs.

*Sciurus Ingrami* was the first of the many discoveries made by Mr. Robert during his highly successful collecting tour in Brazil, and I have now had much pleasure in naming after him the present squirrel, its ally, obtained at the last locality worked by him before his return to Europe.

#### *A Special Genus for Dasypsecta acouchy.*

The long-tailed Agouti, "*Dasypsecta*" *acouchy*, Linn., is clearly a very different animal from all the ordinary members of *Dasypsecta*, and should, I think, be separated generically from them. Its main distinctive features are its well-developed tail and conspicuously smaller teeth, these latter being smaller, both relatively and absolutely, than in any species of *Dasypsecta*.

I would therefore propose to call it *Myopsecta acouchy*.



XLV.—*A new Mongoose from Namaqualand.*

By OLDFIELD THOMAS, F.R.S.

By the generosity of Mr. C. D. Rudd, a trained taxidermist (Mr. C. H. B. Grant) has been enabled to carry on a collecting tour in South Africa on behalf of the National Museum. A specimen of *Lepus capensis* obtained on this expedition has already been referred to above in the description of *Lepus capensis centralis*\*, and I now have the pleasure of describing a very fine and distinct new mongoose found by Mr. Grant in the north-eastern part of the Colony.

It may appropriately be termed

*Herpestes Ruddi*, sp. n.

Size of *H. pulverulentus*, which it appears to represent in Namaqualand. Important characters as in that species, except in regard to the tail-tip. General colour of body rather browner and less grey than in *H. pulverulentus*, owing to the light rings on the hairs being yellowish instead of white and the underfur being darker. Posterior back becoming prominently deep blackish instead of the uniform grizzled grey of the older known species. This blackening is obtained by the long dorsal hairs being broadly black-tipped, with only one small subterminal light band, the underfur being also blackish. Under surface and hind limbs from hips downwards also blacker than in *H. pulverulentus*, the latter part being in some instances deep glossy black. Tail long, bushy, tapering, its hairs (except at the tip) annulated basally with black and dull whitish, their tips being broadly washed with buffy yellow, the general tone of the tail being therefore mixed yellow and black; hairs of end of tail wholly black, forming a glossy black tail-tip 1-2 inches in length.

Skull closely similar to that of *H. pulverulentus*; perhaps rather more heavily built; bullæ rather lower and less swollen. Upper carnassial teeth shorter antero-posteriorly.

Dimensions of the type (measured in the flesh):—

Head and body 347 millim.; tail 315; hind foot (s. u.) 69; ear 26.

Skull: basal length 69; zygomatic breadth 39.5; inter-orbital breadth 16.5; palate length 39.6; breadth between outer corners of  $p^4$  24.5;  $p^4$ , greatest diameter 8, length on outer edge 7; diameter of  $m^2$  3.6.

\* Ann. & Mag. Nat. Hist. ser. 7, vol. xii. p. 344 (1903).

*Hab.* Klipfontein, Namaqualand. Alt. 1000 m.

*Type.* Adult male. Original number 474. Collected 12th May, 1903, by C. H. B. Grant, and presented by C. D. Rudd, Esq.

This handsome mungoose forms a remarkable addition to the mammal fauna of South Africa, being conspicuously different from its only near ally *H. pulverulentus*, and is a noteworthy result of the exploration carried on by Mr. Rudd's patriotic assistance.

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*Report A.*—Is a summary for the year 1899, by the Late Director G. M. Dawson, 1900, noticing in general and particular the various lines of research and results of work by the Geological Surveyors, in Yukon, British Columbia, the Mackenzie and Saskatchewan Districts, Ontario and Quebec, Hudson Bay, New Brunswick, and Nova Scotia. Also work done in the Laboratory, Museum, and Library, together with Statistics of Minerals and Mines, and notices of Palæontology and Zoology.

*Report B.*—On the Atlin Gold-Mining District, British Columbia, by J. C. Gwillim, 1901. Gold-bearing gravels are noted and described, but are not said to offer any great inducement to immigrants. A geological map of the district indicates especially the valleys known, in 1899–1900, to yield gold. Some obscure fossils of Mesozoic age were found near Atlin Lake.

*Report C.*—On the Geography and Geology of Great Bear Lake and of a chain of lakes and streams thence to Great Slave Lake, by G. M. Bell, 1901. Gravels and Boulder-Clay, Tertiary, Cretaceous, Silurian, and Lower Cambrian (or Animikie) strata are noticed as well as intrusive greenstone and crystalline rocks. A series of specimens of rocks from the district are described in an Appendix, by A. E. Barlow.

*Report G.*—On the Geology and natural resources of the area included in the Map of the City of Ottawa and Vicinity, by R. W. Ells, 1901. With an Appendix on the fossils grouped locally and stratigraphically, by H. M. Ami. The geological map illustrating this Report covers an area of 450 sq. miles with Ottawa City as a

centre. It includes exposures of all the Palæozoic formations from the base of the Potsdam Sandstone up to the Medina Shales. Many of the strata are highly fossiliferous.

*Report I.*—On the Iron-Ore Deposits along the Kingstown and Pembroke Railway in Eastern Ontario, by E. B. Ingall, 1901. Numerous borings, mines, and mineral products in the Counties of Frontenac, Lanark, Renfrew, and Leeds are described, and illustrated by plans and a general geological map of the district. An Appendix, very useful to petrologists, by A. E. Barlow, on the microscopic examination of twenty-five rocks associated with the ores is added. And there is a large table of localities and analyses of the magnetites and the hæmatites.

*Report J.*—The Geology of Parts of the Provinces of Quebec and Ontario, by R. W. Ells, 1901. After careful consideration of the earlier opinions on the rocks of this great area of nearly 4000 sq. miles in extent, it is concluded that there is evidence to show that much of what was described in earlier Reports as altered sedimentary rocks must now be accepted as altered igneous rock. This includes the greater bulk of the gneissic Laurentian Rock, also much of the pyroxenic and felspathic rocks, and of the white binary granites or pegmatites often associated with the crystalline limestones. The latter, however, and their associated whitish quartzites, as also certain reddish-grey and black gneisses, may be safely taken as representing true sediments, but highly metamorphosed.—The geological structure is described in detail throughout the district topographically; and good photographs of contorted limestone and gneiss are given in plates iii. and iv. Then the several geological formations (as Utica, Trenton, Black-River, Chazy, Calciferous, and Potsdam) are successively treated as exposed in the district under notice. The apatite, asbestos, graphite, iron-ores, mica, barite, felspar, building-stone, &c. are described as to their occurrence and associated rocks, and orderly lists of the Fossils from the local exposures are added by H. M. Ami.

*Report M.*—On the Surface Geology shown on the Fredericton and Andover Quarter-sheet Maps, New Brunswick, by R. Chalmers, 1902. This Report carefully describes the physiographic features, changes of level, denudation, glaciation and its results, the inland and the marine and freshwater deposits (recent), the soils, and forests. The useful minerals found in the district are also noticed.

*Report O.*—Notes on certain Archæan Rocks of the Ottawa Valley, by A. Osann. Translated from the German by N. N. Evans, 1902. Certain gneisses in the neighbourhood of Ottawa are described in detail, and compared with other rocks of the same kind. The occurrence of Apatite and Mica north of Ottawa is fully treated. The bibliography of the former, its discovery, nature, and origin, is given. It occurs as veins in the gneiss, and is always accompanied

by pyroxenite. Sometimes granite and gabbro are traversed by pegmatite veins, and these in turn by veins of graphite. The vein-minerals with apatite are pyroxene, mica, calcite, and felspar, also actinolite, tourmaline, scapolite, titanite, pyrite, fluorspar, quartz, garnet, epidote, idocrase, zircon, prehnite, cabazite, molybdenite, graphite, &c. A careful exposition is given of the vein-materials, various rocks more or less associated with the apatite-veins, especially certain crystalline schists, and some of the eruptive rocks.

The gneisses, quartzites, vein-granites, and other associated rocks have been impregnated from the veins, hence secondary developments of some minerals, as augite &c.

The Eozoon Limestone of Côte St. Pierre is described in full detail, as occurring just above the contact of the limestone with the mica-hypersthene gabbro, forming the mass of the hill below, and is regarded as having resulted from contact-metamorphism. It is compared with a rock having a similar structure ejected from Vesuvius, and described by Johnston-Lavis and Gregory. The presence of apatite in the "Leopard-rock" of Ottawa is referred to, and the mode of formation of that peculiar augite-gneiss is explained.

Graphite is referred to as being widespread, and is described from two localities—Graphite City in Buckingham Township and in Grenville Township. It occurs mostly in veins, but sometimes diffused from them into the neighbouring rocks of gneiss &c. Like apatite it occurs with hypersthene-biotite gabbro together with scapolite, oxide of tin, hornblende, titanite, and zircon. The graphite distributed in the granular limestone of Canada may well have been derived from the carbon originally in the limestone, and possibly of organic origin, but subsequently modified by the metamorphism which changed the limestone into marble.

It is highly probable, however, that fumarole-action had to do with the formation of both the apatite and graphite veins, filling up cracks and fissures, in the old cooling rock-masses, during their solidification.

*Report R.*—On the Section of Chemistry and Mineralogy, by G. C. Hoffmann, T. G. West, and R. A. A. Johnstone, 1901. This consists of the (1) Results of Miscellaneous Examinations, pp. 1-17; (2) Mineralogical Notes, pp. 18-25; (3) Coals and Lignites, pp. 25-31; (4) Limestones and Dolomites, pp. 31-35; (5) Iron Ores, pp. 35-36; (6) Nickel and Cobalt, pp. 37-38; (7) Gold and Silver, pp. 38-47; (8) Natural Waters, pp. 48-60; (9) Miscellaneous Materials, pp. 60-64. Although made on account of local requirements, these researches are mostly of wide application and general value.

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### XLVI.—*Rhynchotal Notes*.—XIX. By W. L. DISTANT.

THE following descriptions refer to species recently acquired by the British Museum, of which a collection from the neighbourhood of the Abutsi River, Nigeria, is the most important.

Examples and types of the newly described species collected during the Grant and Forbes expedition to the island of Sokotra have now been added to the National Collection, and some remarks are submitted on the list already published and a fuller and revised enumeration proposed.

#### I.—RHYNCHOTA FROM THE ETHIOPIAN REGION.

##### HETEROPTERA.

##### Fam. Pentatomidæ.

##### *Neodius æthiopicus*, sp. n.

Ochraceous, somewhat thickly fuscously punctate, the marginal punctures to basal half of scutellum and to the median vein of corium almost constituting linear narrow fasciæ; fourth and fifth joints of antennæ black; margins of body beneath strongly blackly punctate, on abdomen the punctures forming two somewhat broad sublateral fasciæ;

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antennæ with the second, fourth, and fifth joints almost subequal in length; rostrum reaching the posterior coxæ; head about as broad (including eyes) as long, lateral margins anteriorly narrowed and convexly rounded, cleft between the lateral lobes, which do not quite meet; pronotum with the lateral margins slightly convexly oblique, the anterior angles laterally prominent beyond eyes, the lateral angles non-prominent; membrane shining ochraceous; legs punctured with fuscous; tibiæ strongly sulcated above.

Long.  $11\frac{1}{2}$  millim.; exp. pronot. angl. 6 millim.

*Hab.* Nigeria: Abutsi River (Brit. Mus.).

*Neodius angulatus*, sp. n.

Ochraceous, blackly punctate, the punctures forming about six longitudinal fasciæ on pronotum and two on scutellum; the corium is slightly brownish, with the lateral area ochraceous, the punctures margining the median vein forming a narrow linear fascia; membrane obscure greyish; extreme lateral margins to head, apical and subapical annulations to femora, basal and apical annulations to tibiæ, nearly apical half of rostrum, broad sublateral punctate fasciæ to sternum and abdomen (broadest on abdomen, where it encloses a central ochraceous line), discal transverse abdominal spots, and abdominal apex black; basal joint of antennæ short, creamy white, its base piceous; second joint fuscous, lineately black above; head about as broad (including eyes) as long, its margins a little reflexed, convexly rounded at apex, cleft between the lateral lobes, which do not quite meet; pronotum with the anterior angles distinctly prominently dentate, the posterior lateral angles more longly dentate; rostrum reaching the posterior coxæ.

Long.  $12\frac{1}{2}$  millim.; exp. pronot. angl.  $6\frac{1}{2}$  millim.

*Hab.* Nigeria: Abutsi River (Brit. Mus.).

Genus ECTMETOCARA.

*Ectmetocara*, Bergr. Rev. d'Entom. x. p. 214 (1891), n. nom.

*Candace*, Stål, En. Hem. i. p. 76 (1870), nom. præocc.

*Ectmetocara virescens*, sp. n.

Head, pronotum, scutellum, and corium metallic green; membrane cupreous; apex of scutellum, legs, head beneath, rostrum, sternum and coxæ, and base of lateral margin to corium luteous; abdomen beneath dark brownish ochraceous; an oblique fascia on each side of prosternum, lateral

areas of meso- and metasterna, and lateral margins and apex of abdomen more or less dark olivaceous; connexivum above and beneath piceous, spotted with luteous; antennæ ochraceous, with dark marginal lines, apical joint piceous, with its base ochraceous; tibiæ strongly sulcated above, their margins linearly piceous; second joint of antennæ longest, third and fourth subequal; pronotum with the lateral angles very broadly rounded, finely granulate, and obscurely transversely rugulose; scutellum distinctly transversely rugulose; corium very finely granulate; rostrum reaching the intermediate coxæ.

Long., ♂ 15, ♀ 20 millim.; exp. pronot. angl., ♂ 9, ♀  $10\frac{1}{2}$  millim.

*Hab.* Nigeria: Abutsi River (Brit. Mus.).

*Gonopsis recurva*, sp. n.

Reddish brown; lateral and basal margins of head, a transverse central discal line to anterior lobe of pronotum, a central line (posteriorly evanescent) and sublateral fasciæ to scutellum, lateral margins of corium, and a longitudinal fasciæ on each lateral disk of sternum luteous; an irregular central patch on anterior area of pronotum, the anterior tibiæ, a lateral fascia on each side of sternum, stigmata, and a narrow fascia (extending about halfway from base) black; antennæ with the second, fourth, and fifth joints subequal in length, apical half of fifth ochraceous; pronotum with the lateral margins of the anterior lobe serrate, the posterior lateral angles angularly produced, their apices distinctly recurved, a carinately raised slightly curved line between them, in front of which the surface is finely rugulose, and behind which it is strongly rugulose; scutellum transversely rugulose; corium thickly finely punctate; membrane greyish white, only just passing base of anal segment.

Long. 15 millim.; exp. pronot. angl. 8 millim.

*Hab.* Tanganyika (Brit. Mus.).

Fam. Lygæidæ.

*Aphanus mirabilis*, sp. n.

Head piceous, thickly palely pilose, the apex ochraceous; antennæ black, under surface of first joint, and fourth joint (excluding apex), luteous; pronotum luteous, brownly punctate, the margins and a central longitudinal line impunctate, two large spots occupying nearly the whole of anterior lobe and four spots in transverse series on posterior lobe black;

scutellum black, two lateral fasciæ meeting beyond middle and the extreme apex luteous; corium luteous, clavus (excluding outer margin), a subclaval elongate spot, a large somewhat rounded discal spot a little beyond middle, and a spot at apical angle black; membrane black, its apical margin luteous; body beneath piceous black, opaque; rostrum, margins of prosternum, posterior margins of metasternum, lateral margins of abdomen, coxæ, trochanters, and legs luteous; first joint of antennæ shorter than head, but passing its apex, second and fourth joints subequal in length; scutellum coarsely punctate, except on luteous fasciæ; corium coarsely punctate, apices of tarsi black.

Long.  $8\frac{1}{2}$  millim.

*Hab.* Fernando Po: St. Isabel (Brit. Mus.).

A Lygæid with the bright coloration of a Pyrrhocorid.

### Fam. Hydrometridæ.

#### *Rhagovelia maculata*, sp. n.

Piceous black; anterior margin of pronotum, base of first joint of antennæ, connexivum above and beneath, base of rostrum, acetabula, coxæ, trochanters, bases of femora above, and the greater part of femora beneath luteous; hemelytra with a narrow streak at base, two short parallel subbasal streaks, two other parallel elongate spots a little before middle, and a small spot at about centre of inner margin bluish grey; antennæ, legs, and margins of pronotum somewhat longly pilose; first joint of antennæ longest, outwardly curved, second and fourth subequal, each slightly shorter than third.

One winged and five apterous specimens.

Long.  $3\frac{1}{2}$  millim.

*Hab.* Nigeria: Abutsi River (Brit. Mus.).

#### *Metrocoris æthiops*.

*Apterous*.—♂. Ochraceous; antennæ (excluding base), eyes, apex of rostrum, margins and a central line to pronotum, anterior and posterior margins, a central line and a curved dentate fascia near each lateral margin to mesonotum, margins and a central line to metanotum, lateral abdominal and posterior segmental margins above, margins of posterior coxæ above, a sublateral fasciate line (not reaching base) and basal margin of sternum, and a lineate spot on intermediate acetabula black; anterior femora ochraceous, with a fuscous line above; anterior tibiæ and



tarsi and intermediate and posterior legs fuscous. Ovate, widest in the middle; first joint of antennæ long, strongly but sparsely serrate beneath, second and fourth joints shortest and subequal in length, third a little longer than either second or fourth; anterior femora with a few long hairs or bristles beneath, the femora and tibiæ about equal in length, intermediate tibiæ not much more than half the length of femora, posterior tibiæ less than half the length of femora.

♀. Antennæ with the first joint ochraceous, its extreme apex black.

Long., ♂ 4, ♀ 3 millim.; max. breadth, ♂ ♀, 2 millim.

*Hab.* Nigeria: Abutsi River (Brit. Mus.).

*Metrocoris natalensis*, sp. n.

Pale ochraceous; antennæ (excluding base), head with eyes, a broad transverse curved fascia between their posterior areas connected centrally with base, a rounded spot before apex, and an angulated linear spot at inner margin of eyes, pronotum with the anterior and lateral margins, a central longitudinal fascia, a waved transverse fascia near base, and a large elongate spot on each lateral area connected with anterior margin, transverse dorsal segmental abdominal fasciæ, irregular macular markings to intermediate and posterior coxæ, longitudinal lines to femora, the tibiæ and tarsi, and apex of rostrum black; body broad, widening to intermediate and posterior coxæ; head broad, its apex rounded; rostrum with the third joint almost twice as long as first and second together; antennæ with the first joint shorter than second and third together; anterior femora and tibiæ almost equally long.

Long., ♀,  $4\frac{3}{4}$  millim.; max. breadth  $3\frac{1}{2}$  millim.

*Hab.* Natal: Pirie Bush (*A. N. Stenning*, Brit. Mus.).

Fam. Reduviidæ.

*Tribelocephala oculata*, sp. n.

Chocolate-brown; eyes black; anteocular portion of head, antennæ, rostrum, legs, and venation to corium ochraceous; body beneath brownish ochraceous, lateral margins broadly ochraceous; eyes meeting on upper surface of head; antennæ pilose, first joint robust, a little shorter than second, second and remaining joints luteous; pronotum with the posterior angles rounded; membrane a little darker in hue than corium, very broad and considerably longer than corium.

Long. 7 millim.

Fernando Po (Brit. Mus.).

This species is, so far as known at present, unique in having the eyes meeting on upper surface of head.

#### SYNONYMICAL NOTE.

Dr. Bergroth (Ann. Soc. Ent. Belg. 1903, p. 297) has referred to four species of Tingididæ from South Africa which I recently described under the genus *Phatnoma*, and states that three of these belong to the allied genus *Gonycentrum* (*Telia*, Fieb., nom. præocc.). He also writes: "La structure du pronotum est la seule différence valable entre ces deux genres." In these statements I do not think the writer has shown his usual acumen. The structure of the pronotum is not the only good dividing character between these two genera; the transverse raised lines to the discoidal and subcostal areas of the elytra constitute a distinct character of *Phatnoma*, not found in *Gonycentrum*, besides which the structure of the head in both genera, as shown by Fieber's excellent figures, is another point of division.

The three species I have described and figured under the genus *Phatnoma* cannot therefore be placed in *Gonycentrum*, as Dr. Bergroth definitely states, and if they are to be separated from the first-named it must be by the construction of a new genus. To separate species from a genus to which they have most affinity and place them in another to which they do not belong tends rather to obscurantism than to correction.

## II.—RHYNCHOTA FROM THE ORIENTAL REGION AND CHINA.

### HETEROPTERA.

#### Fam. Pentatomidæ.

##### *Sepontia formosa*, sp. n.

Head black, coarsely and thickly punctate; pronotum ochraceous, basal area from between the lateral angles and a large spot on each side of anterior margin black, the basal area strongly and coarsely punctured, some scattered black punctures on each central lateral area and at centre of anterior area, the lateral margins levigate; scutellum black, thickly and coarsely punctate, with two very large transverse luteous levigate spots near anterior margin; corium black, thickly and coarsely punctate, ochraceous at base; body

beneath ochraceous, sternum coarsely brownly punctate, disk of abdomen black; legs brownish ochraceous, spotted with fuscous; antennæ with first and second joints brownish ochraceous, remainder mutilated.

Long.  $4\frac{1}{2}$ – $5\frac{1}{2}$  millim.; exp. pronot. angl.  $3\frac{1}{2}$ –4 millim.

*Hab.* Malayan Archipelago: Tomia (Brit. Mus.).

Fam. Hydrometridæ.

Subfam. *VELINÆ*.

*ALARDUS*, gen. nov.

Body elongate; pronotum narrow, longer than broad, posteriorly angularly produced, the areas before and behind the latitude of the lateral angles about equal, lateral margins slightly and obscurely reflexed, lateral angles subnodulose; antennæ pilose, first joint longest, second, third, and fourth joints subequal; hemelytra not quite reaching abdominal apex; legs pilose, posterior legs a little longest, the tibiæ distinctly longest; tarsi three-jointed, intermediate tarsi scarcely longer than the posterior tarsi.

*Alardus typicus*, sp. n.

Head and pronotum ferruginous, the last (excluding central fascia and lateral margins) fuscous; hemelytra brownish ochraceous, with a discal longitudinal line and suffusions on apical area piceous; basal angles, three large spots (one elongate and apical, one anteriorly rounded at about one third from apex, one linear and submarginal), and a number of minute spots on apical half greyish white; body beneath piceous, palely pilose; connexivum above and beneath, acetabula, coxæ, and legs luteous; femora with a subapical annulation, anterior and intermediate tibiæ with basal and apical annulations, and posterior tibiæ with a basal annulation pale brownish.

Long.  $4\frac{1}{2}$  millim.

*Hab.* Malay Peninsula: Province Wellesley (*H. N. Ridley*, Brit. Mus.).

Fam. Reduviidæ.

*Tribelocephala ornata*, sp. n.

Anteocular portion of head, antennæ, rostrum, legs, and corium ochraceous; postocular portion of head and anterior

lobe of pronotum piceous; posterior lobe of pronotum, scutellum, clavus, two large discal longitudinal fasciæ to corium (not quite reaching base or apex, and divided by the ochraceous veins), and membrane pale chocolate-brown; body beneath pale brownish, thickly ochraceously pubescent, abdomen with a central longitudinal incised line; apices of the tibiæ and bases of anterior and intermediate tarsi fuscous; eyes black, their inner margins almost meeting; antennæ strongly pilose, second joint a little longer than first; pronotum with the posterior angles distinctly nodulose; corium much shorter than membrane; tibiæ longly pilose.

Long.  $7\frac{1}{2}$  millim.

*Hab.* Dinding Islands, near Penang (*H. N. Ridley*, Brit. Mus.).

*Hæmatolæcha fokiensis*, sp. n.

Coral-red; head, antennæ, rostrum, transverse and longitudinal impressions to pronotum, scutellum, apical two thirds of clavus and a fused elongate spot on corium, membrane, sternum, legs, segmental incisures, a broad sublateral fascia, and anal segment to abdomen beneath black; coxæ, trochanters, and apical spines to scutellum piceous; tarsi brownish ochraceous; antennæ strongly pilose; intermediate and posterior femora obsoletely nodulose near apices; pronotal impressions strongly rugose.

*Var.*—Disk of corium more or less suffused with pale piceous.

Long. 11 millim.

*Hab.* China: N.W. Fokien (*La Touche*, Brit. Mus.).

SYNONYMICAL NOTES.

Dr. Gestro, of the Genoa Museum, having obliged me with an opportunity of examining and figuring the *Aradidæ* collected by Sign. Fea in Burma and Tenasserim, the following synonymy may be noted:—

Genus EUMENOTES.

*Eumenotes*, Westw. Tr. Ent. Soc. iv. p. 246 (1847).

*Odonia*, Bergr. Ann. Mus. Civ. Gen. xxvii. p. 733 (1889).

*Eumenotes obscura*.

*Eumenotes obscura*, Westw. Tr. Ent. Soc. iv. p. 247, pl. xviii. fig. 4 (1847).

*Aradus truncatus*, Walk. Cat. Het. vii. p. 39 (1873).

*Odonia truncata*, Bergr. Ann. Mus. Civ. Gen. xxvii. p. 733, pl. xii. fig. 4 (1889).



*Brachyrhynchus lateralis*.*Crimia lateralis*, Walk. Cat. Het. vi. p. 14. 7 (1873).*Brachyrhynchus montanus*, Bergr. Ann. Mus. Civ. Gen. xxvii. p. 738 (1889).

## III.—RHYNCHOTA OF SOKOTRA.

The volume relating to the natural history results of the expedition to this island made by Mr. W. R. Ogilvie-Grant and Dr. H. O. Forbes having just been published, and the Rhynchota determined by Mr. Kirkaldy having been received at the British Museum, it is necessary to make a few notes to prevent any confusion arising as to the real affinities of this interesting fauna, so far as these insects are concerned. Some corrections I have already made do not appear in the text, and therefore it is best to add in some cases what has previously appeared.

## HETEROPTERA.

## Fam. Pentatomidæ.

Subfam. *CYDNINÆ*.*Cydnus attar*.*Geotomus attar*, Kirk. Nat. Hist. Sokotra and Abd-el-kuri, p. 390, pl. xxiii. figs. 9, 9 a (1903).Subfam. *DINIDORINÆ*.*Aspongopus viduatus*.*Cimex viduatus*, Fabr. Ent. Syst. iv. p. 117 (1794).*Aspongopus assar*, Kirk. Bull. Liverp. Mus. ii. p. 4 (1899); Nat. Hist. Sokotra and Abd-el-kuri, p. 389, pl. xxiii. fig. 10 (1903).

A widely distributed African species, found also in Egypt and Syria. I am now inclined to consider the Matabele insect I described as *A. japedus* to be only an extreme form of this species.

## Fam. Coreidæ.

Subfam. *CORIZINÆ*.*Serinetha abdominalis*.*Lygæus abdominalis*, Fabr. Syst. Rhyng. p. 226 (1803).Var. *Serinetha taprobanensis*, Dall. List Hem. ii. p. 461 (1852).*Leptocoris bahram*, Kirk. Bull. Liverp. Mus. ii. p. 46 (1899); Nat. Hist. Sokotra and Abd-el-kuri, p. 387, pl. xxiii. fig. 8 (1903).

Found throughout British India and Ceylon.

## Fam. Lygæidæ.

Subfam. *APHANINÆ*.*Dieuches Forbesii*.

*Aspilocoryphus Forbesii*, Kirk. Bull. Liverp. Mus. ii. p. 46 (1899); Nat.

Hist. Sokotra and Abd-el-kuri, p. 385, pl. xxiii. fig. 6 (1903).

*Dieuches Forbesii*, Dist. Ann. & Mag. Nat. Hist. (7) viii. p. 504 (1901).

## HOMOPTERA.

*Melampsalta tibialis*.

*Tettigonia tibialis*, Panzer, Faun. Germ. fasc. lix. tab. v. (1798).

*Melampsalta omar*, Kirk. Bull. Liverp. Mus. ii. p. 45 (1899).

*Cicadetta omar*, Kirk. Nat. Hist. Sokotra and Abd-el-kuri, p. 381, pl. xxiii. figs. 1, 1 a, 1 b (1903).

There are two species among the specimens procured: Kirkaldy's typical (*a*) is Panzer's species, common in Greece and Istria; the second (*var.*) is a distinct species, but requires further comparison with some at present inaccessible Palæarctic types.

*Species returned unidentified to the British Museum.*

## Fam. Pentatomidæ.

*Carbula trisignata*.

*Cimex trisignatus*, Germ. in Silberm. Rev. p. 17 (1837).

*Hab.* Sokotra: Dahamis, Adho Dimellus (*Grant*).

A well-known South- and East-African species.

*Nezara Heegeri*.

*Nezara Heegeri*, Fieb. Eur. Hem. p. 331 (1861).

*Hab.* Sokotra: Hadibu Plain (*Grant*).

A Southern Palæarctic species, already recorded from Northern Africa and Arabia. This is evidently the *Nezara* referred to by Kirkaldy (Nat. Hist. Sokotra and Abd-el-kuri, p. 391).

## Fam. Coreidæ.

*Euthetus leucostictus*.

*Euthetus leucostictus*, Stål, Cefv. Vet.-Ak. Förh. 1855, p. 30.

Sokotra (no precise locality) (*Grant*).

## Fam. Reduviidæ.

## Subfam. ACANTHASPINÆ.

*Holotrichius insularis*, sp. n.

♀. Dark fuscous, black beneath; antennæ (excluding basal joint), anterior angles and carinæ of anterior pronotal lobe, lateral angles of posterior lobe, apex of scutellum, pronotum above (excluding base), extreme bases of anterior tibiæ, and a broad subbasal annulation to posterior tibiæ brownish ochraceous; head about as long as pronotum, finely granulose; eyes setose; antennæ longly setose, basal joint distinctly curved; pronotum as long as broad at base, anterior angles tuberculously spinous, anterior lobe very much longer than posterior lobe, tumid, strongly sculptured, lateral margins convex; posterior lobe with the lateral angles shortly tuberculously spinous; scutellum with the apex shortly, conically, laterally produced; abdomen broad, ovate, posteriorly narrowed, lateral margins reflexed, above with a double, discal, segmental series of fuscous spots, apex fuscous; legs thickly setose.

Long., ♀, 16 millim.

*Hab.* Sokotra: Jena-agahan (*Grant*, Brit. Mus.).

*Species collected during the Balfour Expedition.*

## Fam. Pentatomidæ.

*Brachynema Balfouri*, sp. n.

Head, pronotum, scutellum, and corium greyish white, thickly punctured with fuscous; head, the lateral margins, and an irregular transverse waved fascia to anterior area of pronotum with the ground-colour pale cretaceous; lateral margins of head (not reaching apex) and the margins of the central lobe piceous; membrane pale hyaline, the veins pale fuliginous; antennæ, rostrum, body beneath, and legs pale creamy white; apical halves of third, fourth, and fifth joints of antennæ, apical joint of rostrum, a spot on each lateral area of prosternum, two spots on each lateral area of mesosternum, two subapical spots to femora, and the apices of the tarsi dark fuscous or piceous; abdomen beneath (excluding disk and lateral margins) thickly darkly, somewhat coarsely punctate, sternum more finely punctate; legs finely

speckled with fuscous; antennæ with the second and fifth and third and fourth joints subequal in length; rostrum just passing the posterior coxæ.

Long. 9 millim.

*Hab.* Sokotra (*Prof. I. B. Balfour*, Brit. Mus.).

A distinctly Palæarctic genus.

*Enumeration of the recorded Rhynchota from the  
Island of Sokotra.*

HETEROPTERA.

Fam. Pentatomidæ.

Subfam. CYDNINÆ.

1. *Cydnus attar*, Kirk.

Subfam. PENTATOMINÆ.

2. *Carbula trisignata*, Germ.  
3. *Chroantha ornatula*, Herr.-Sch.  
*Chroantha? hataska*, Kirk.  
4. *Brachynema Balfouri*, Dist.  
5. *Nezara Heegeri*, Fieb.

Subfam. DINIDORINÆ.

6. *Aspongopus viduatus*, Fabr.  
*Aspongopus assar*, Kirk.

Fam. Coreidæ.

Subfam. ALYDINÆ.

7. *Euthetus leucostictus*, Stål.  
8. — *Granti*, Kirk.

Subfam. CORIZINÆ.

9. *Serinetha abdominalis*, Fabr.  
*Leptocoris bahram*, Kirk.

Fam. Lygæidæ.

Subfam. GEOCORINÆ.

10. *Geocoris sokotranus*, Kirk.

Subfam. APHANINÆ.

11. *Dieuches Forbesii*, Kirk.

Fam. Pyrrhocoridæ.

12. *Pyrrhocoris* sp.\*

Fam. Hydrometridæ.

13. *Velia* sp.\*

Fam. Reduviidæ.

Subfam. ACANTHASPINÆ.

14. *Reduvius azrael*, Kirk.  
15. *Holotrichius insularis*, Dist.

Fam. Cimicidæ.

16. *Cimex horrifer*, Kirk.

HOMOPTERA.

Fam. Cicadidæ.

17. *Melampsalta tibialis*, Panz.  
*Melampsalta omar*, Kirk.  
18. *Melampsalta* sp.

Fam. Fulgoridæ.

19. *Elasmoscelis iram*, Kirk.

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\* Fide Taschenberg, Zeitschr. für Naturw. lvi. p. 183 (1883).



XLVII.—*A Revision of the Genera of the ARANEÆ or Spiders, with Reference to their Type Species.* By FREDK. PICKARD-CAMBRIDGE, B.A., F.Z.S.

THIS sixth instalment of the series commenced in the Ann. & Mag. Nat. Hist. ser. 7, vol. vii., for Jan. 1901, includes all the genera founded by Walckenaer in the 'Tableau des Aranéides,' published in 1805, and in addition three other genera published by Latreille in 1806 and 1809, Gen. Crust. Ins. i. p. 109, and *op. cit.* iv. p. 371, the two in the latter volume being here attributed to Walckenaer on the grounds that Latreille was merely publishing Walckenaer's "Manuscrit communiqué," according to the former's express statement.

*Corrigenda.*

1. *ATYPUS.*

In Ann. & Mag. Nat. Hist., Jan. 1901, p. 57, under *Atypus*, the words "which Latreille identified by mistake as belonging to this genus" should be deleted. The facts are more correctly stated thus:—Rømer fancied, though erroneously, that his species was congeneric with *Aranea aquatica*, Fabr. But there is no possible doubt that his figure represents an adult male of some species of *Atypus*. It is, however, impossible to say now which of the three European forms is represented by the name *subterranea*, or indeed by any of the earlier names, *piceus*, *difforme*, or *Sulzeri*.

The type of *Atypus* would, however, be more correctly quoted as *Atypus subterraneus* (Rømer).

2. *CERATINELLA.*

In Ann. & Mag. Nat. Hist. (7) vol. xi., Jan. 1903, p. 44, the type of *Ceratinella*, Emerton, is there given by a slip of the pen as *C. brevis* (Wider). This is, of course, incorrect, since this species was not originally included in Emerton's group, and cannot serve as the type. I therefore here select *Ceratinella Emertoni* (O. P.-Cambr.) as the type of the genus *Ceratinella*.

*List of Genera referred to.*

*Lycosa*, Latreille, p. 483.  
*Guaphosa*, Latreille, p. 485.  
*Micromata*, Latreille, p. 486.  
*Oletera*, Walckenaer, p. 488.  
*Missulena*, Walckenaer, p. 488.  
*Ctenus*, Walckenaer, p. 488.  
*Sphasus*, Walckenaer, p. 488.  
*Eresus*, Walckenaer, p. 489.  
*Attus*, Walckenaer, p. 489.  
*Thomisus*, Walckenaer, p. 491.  
*Sparassus*, Walckenaer, p. 492.

*Drassus*, Walckenaer, p. 492.  
*Agelena*, Walckenaer, p. 493.  
*Nyssus*, Walckenaer, p. 493.  
*Epeira*, Walckenaer, p. 493.  
*Theridion*, Walckenaer, p. 494.  
*Pholcus*, Walckenaer, p. 494.  
*Latrodectus*, Walckenaer, p. 495.  
*Storena*, Walckenaer, p. 495.  
*Uloborus*, Latreille, p. 495.  
*Clotho*, Walckenaer, p. 495.  
*Episinus*, Walckenaer, p. 495.

I must first of all write a few lines in reply to Dr. Dahl, who challenged the types referred to certain genera immediately on the publication of my first paper dealing with the genera of Latreille, *Nouv. Dict. Hist. Nat.* xxiv. (1804), namely *Gnaphosa*, *Micromata*, and *Lycosa*. It need scarcely be said that all criticisms are welcome in an undertaking of this kind, because it is almost impossible for a single author not to pass over some important detail here and there throughout the whole literature, and one is glad to have his attention called to the fact.

Dahl was good enough to point out that I had not read Latreille's works, or if I had, that I did not understand the meaning of what was written. Without laying claim to omniscience in any matter, I may, however, explain that I am perfectly well acquainted with the various works and passages contained in them to which Dr. Dahl refers, although I must confess that I cannot venture to interpret some of the latter with the same confidence as to their meaning that he himself manifests; nor am I at all sanguine that anyone else would agree with me if I did.

In connection, for instance, with Latreille's work mentioned above, I cannot agree that it is at all clear what that author did or did not mean when he quoted Walckenaer's "*denominations*" in immediate relation to his newly-founded genera. For he himself says explicitly that he wishes to preserve his own divisions and names because he prefers them to those of Walckenaer.

But why, then, did he not *quote his own denominations*, "Vagabondes" Div.\* &c., &c., when he founded his genera? He cannot be quoting Walckenaer's denominations for the sake of the names themselves, some of which he declares to be absurd, so that we are left to conclude that he does so with respect to the species involved. And if he does not, then are many of his generic names "*nomina nuda*," connected with diagnoses but unaccompanied by species quoted by name or definitely referred to without possibility of mistake.

If he does mean to include the species understood by Walckenaer's "*denominations*," the question is, how many and which of them? We may refer, as a guide to our decision, to Latreille's table, *Hist. Nat. Crust. Ins.* vol. iii. p. 60, where, referring to these same "*denominations*" of Walckenaer, he says: "*elles répondent à mes Vagabondes Div.\**, &c., &c."

But what does *répondent* mean in this connection? One cannot agree that when he says, *e. g.*: "*Chasseuses répondent à mes Vagabondes, Div.\**," that he means to *exclude* all the

species under *Chasseuses* except the two mentioned under this Div. \* on page 48, of which, by the way, *one* does not occur under *Les Chasseuses* at all. Nor can one be certain that he means to include all those under *Les Chasseuses* as well.

The fact is that it is *impossible* now to determine what Latreille did or did not mean, so that, failing to understand what was intended, in my first publication dealing with these genera I simply took the printed fact as it stood, the "*denomination*" quoted, with all the species originally included in it, as the best way out of the difficulty.

I have no wish to advocate any particular theory as to what Latreille meant, but am determined, if possible, to settle the matter for the time being in the manner least likely to leave room for disputation.

The same remarks apply also to the case of the other genera, besides *Lycosa*, namely *Micromata* and *Gnaphosa*, whose particular problems are dealt with in detail below.

#### LYCOSA, Latreille, 1804.

Latreille, when he founded the genus, writes as follows :—  
"B —" (diagnosis)—"*(Lycosa)*—*Les Chasseuses* de Walck."

In his Hist. Nat. Crust. Ins. vol. iii. p. 60, published before 1804, he says of *Les Chasseuses* : "*elles répondent à mes—Vagabondes Div. \**"; but when he founds the genus *Lycosa*, instead of quoting his own denomination, "*Vagabondes Div. \**," he definitely connects his generic name with Walckenaer's denomination alone, without offering any modification.

The question is, what did Latreille mean? There are three alternatives open to us, depending upon the attitude we take up as to what Latreille meant when he quoted *Les Chasseuses*, and what he intended to be understood by "*répondent.*"

It is a perfectly justifiable conclusion that whatever he wrote before as to the relation of *Les Chasseuses* to his own *Vagabondes*, the fact that he quotes the former in connexion with his generic name proves clearly that he has changed his mind.

When I wrote on the type of this genus in Jan. 1901, I took up the position that, whatever he said or wrote before or after the founding of the genus *Lycosa*, when he did actually bestow the name, he did so solely in connexion with *Les Chasseuses*; and I considered that by confining our attention simply to the species directly referred to we were

following the safest course for the avoidance of disputation as to the meaning of words and phrases. No one can ever dispute the fact that immediately after *Lycosa* Latreille wrote *Les Chasseuses* de Walek., and this is the only point that is not open to dispute. He did not write "*Vagabondes* Div.\*," though he possibly intended to do so. We cannot, however, concern ourselves with possibilities, but simply with the species included under the denomination which he did write after his generic name. This, at least, is my own position in the matter, acting in strict accordance with the rules I am following.

(1) Including only the species under *Les Chasseuses*, we have left in, under *Lycosæ propriæ*, by Sundevall (Vet.-Akad. Handl. 1832, p. 173), when he made his new genera *Tarentula* and *Pirata*, two only of the original species, *L. sylvicola* (= *lugubris*) and *L. amentata* (= *saccata*). In 1848 C. L. Koch refers *amentata* (under the name *paludicola*) to his new genus *Leimonia*; while he refers *lugubris* (under the name *alacris*) to his new genus *Pardosa*, but on a *later page of the same work*. This species, being the last left in, remains as the type of the genus *Lycosa*.

(2) If we take into consideration *Les Chasseuses*, plus *Ar. tarentula* and *Ar. saccata*, Latreille's *Vagabondes* Div.\* , then we shall find the type to be *Ar. tarentula*, since this author cited it himself in 1810. Simon is perfectly correct in his conclusion as to the type, and in his 'Araclnides de France' shows that he too respects a selected type, for he says: "*Les Lycosa tarentula* on été choisies par Latreille comme types du genre *Lycosa*."

Type, *L. tarentula*.

(3) If we ignore, as does Dahl, Latreille's citations in 1810, then we have to pass on to consider Sundevall's action in 1832 when he founded the genus *Tarentula*. Sundevall does not mention the species *L. tarentula* by name, and it cannot therefore be taken into consideration.

Dr. Dahl says: "According to the definition of the subgenera, this species must be included in the subgenus *Tarentula*." Now this action is absolutely inadmissible, because according to our rules we cannot admit into any generic group a species not actually included by name, or directly referred to, at the time when the genus is founded.

*Lycosa tarentula* cannot be the type of *Tarentula*, Sund.

We have, then, two courses open to us. If we include *Ar. tarentula* at all in the original group under *Lycosa*, then this species is its type. If we do not include this species,



nor *L. saccata*, then *L. lugubris*, Walck., is the type, since this was the last species left in by C. L. Koch in 1848.

If the question be settled by reference to the first authority who came to some definite conclusion on the point—since we are confronted by three authors, Thorell, Simon, and Dahl, each of whom furnishes us with a different type species—we must naturally take Thorell's decision made in 1869–70, when he gives *Lycosa lugubris*, Walck., as the type.

Personally I adhere to my own conclusion (Ann. & Mag. Nat. Hist. (7) vii., Jan. 1901), reached by a rigid application of rules, see Case 1 above, which leaves us with *L. lugubris* as the type.

Type, *Lycosa lugubris* (Walck.), 1802.

GNAPHOSA, Latreille, 1804, Nouv. Dict. xxiv. p. 134.

Latreille writes thus: "D. A. (diagnosis)—(*Gnaphosa*)—*Les Celluliformes* de Walck."

In the note below he adds: "la subdivision a de coupe D une partie des araignées tisserands à pattes moyennes."

In his table in Hist. Nat. Crust. Ins. vol. iii. p. 60, Latreille says: "Les Celluliformes—répondent à mes tapisnières Div. 4\*\*\*."

On page 54 of the same work we find under Tapisnières Div. 4\*\*\*, *Ar. relucens*, Latr., and this division is a part of the "*octonoculées tisserands à pattes moyennes*."

Now the *Celluliformes* de Walck. comprise *nocturna*, *lucifuga*, *lapidosa*, and *fulgens*, Wlk.

If we turn to Hist. Crust. Ins. vol. vii. p. 125, we find the same four species included, all of them forming a part of the "*tisserands à pattes moyennes*," with the addition of *Ar. melanogaster*, Latr., and six other species. One cannot, however, admit this later addition to the species originally included in the genus (for, see 'Index Animalium,' Davies Sherborn, MS., this volume appeared after Nouv. Dict. xxiv.), and vol. vii. simply proves that the four species mentioned above constitute "une partie des araignées tisserands à pattes moyennes."

There are three courses open to us:—

(1) If we take the species mentioned on page 54, Hist. Nat. Crust. Ins. vol. iii., only, under Div. 4\*\*\*, then *Ar. relucens*, Latr. (= *fulgens*, Wlk.), is the type of the genus.

(2) If we include those under *Les Celluliformes* and the one quoted on page 54, we have the same four species, for *relucens*=*fulgens*, Wlk.

(3) So too, of course, if we include *Les Celluliformes* alone.

In the last two cases my original decision, published in *Ann. & Mag. Nat. Hist.* (7) vii., Jan. 1901, p. 58, holds good. Walckenaer removed all the species except *lapidosa* to his new genus *Drassus* ('Tableau,' p. 45), as he had a perfect right to do, and left in *lapidosa*, which thus remains as the type. This is a plain straightforward case of elimination. I do not see how it is possible to get away from these facts.

Dahl remarks with regard to the type of this genus ('Archiv für Naturgeschichte,' 1901, p. 55):—"We reach the same type if, with F. O. P.-Cambridge, we entirely ignore Latreille's text and hold to the names alone"—namely, *Ar. melanogaster*, Latr. On the contrary, this is precisely what we do not do.

Personally I still adhere to the position represented in Case 3 above, which gives us *lapidosa* as the type and not *melanogaster*. I would certainly much prefer to retain the old signification of *Gnaphosa*, as it has been known to me for more than thirty years; but if an author followed his personal inclinations in every case, he would not be consistent for two genera in succession.

Type, *Gnaphosa lapidosa* (Walck.).

MICROMATA, Latreille, *Nouv. Dict.* vol. xxiv. p. 135.

Here are the facts printed in connexion with the bestowal of this generic name by Latreille:—

"4. *Ar. Crabes* \*.

A.—(Diagnosis).

a.—(Diagnosis)—(HETEROPODA) Les Cordiformes de Walck.

a. *Ar. venatoria*, Linn.

b. Espèce de la *Nouv. Holl.*

B.—(Diagnosis)—(MISUMENA) *Aranea citrea*, De Geer.

C.—(Diagnosis)—(MICROMATA) Les Grottiiformes de Walck.

Placez auprès de cette coupe la première sect. des Cordiformes de Walck."

Twenty species were included under "Les Cordiformes de Walck." Of these, *Ar. citrea* is referred to *Misumena* by Latreille himself three lines further down below *Heteropoda*; three others, *Ar. oblonga*, *Ar. argentata*, and *Ar. rhomboica*, being those included in "La première sect. des Cordiformes de Walck.," were apparently intended to be included with Les Grottiiformes under *Micromata*.

I must confess that, being unable to understand what Latreille's intentions were with regard to this first section of Cordiformes, I considered it better to ignore the note altogether.

If, however, we take full cognizance of it, then, whatever Latreille may or may not have intended, the quotation above

represents precisely what he did and published when he founded these genera. With regard to the *Cordiformes*, he has simply himself broken up his own genus *Heteropoda*, and withdrawn one species under *Misumena*, and three more (la première sect.) under *Micromata*. The genus *Heteropoda* was next broken up by Walckenaer, who removed all the rest of the *Cordiformes*, except *emarginata* and *venatoria*, to *Thomisus* ('Tableau,' p. 28, 1805).

In 1869-70 Thorell cited the latter of these two species as the type of *Heteropoda*. My statement of the case in connexion with *Ar. emarginata* (Ann. & Mag. Nat. Hist. (7) vii., Jan. 1901, p. 62) is not adequate; for the withdrawal by Walckenaer in 1820 is not a valid removal of *emarginata* according to our rules, though the result remains the same.

Of *Misumena*, the type is, of course, *Ar. citrea*.

The case of *Micromata* is more involved. The species falling under the genus are those included under *Les Grotti-formes*—*Ar. smaragdula*, Fabr., *Ar. ornata*, Walck., *Ar. rosea*, Walck., and *Ar. accentuata*, Walck.; and if we take cognizance of the note we shall include also those of the first section of the *Cordiformes*, namely *Ar. oblonga*, Walck., *Ar. argentata*, Walck., and *Ar. rhomboica*, Walck.

Thorell himself (1869-70) took no notice of this note following *Micromata*; but it makes no difference whether we include the first section of *Cordiformes* or not, for all these species were referred by Walckenaer to his new genus *Thomisus* in 1805 ('Tableau,' p. 28).

We are thus left with the four "*Grotti-formes*"—*smaragdula*, *ornata*, *rosea*, and *accentuata*—the last of these being stated by Thorell to have been "placed there by mistake."

Now in a later work (Hist. Nat. Crust. Ins. vol. vii. p. 226), Latreille has a note to this effect: "*On placera dans cette division l'araignée accentuée de Walckenaer*," i. e. under the "*Tisserands à pattes moyennes*."

The question is, how far are we justified in entertaining subsequent modifications of generic groups, so far as these relate to the species originally referred to them?

For myself I hold, as I held when my first paper dealing with this genus was written, that if we are to maintain any consistency of treatment, such modifications must be ignored. This course leaves us with *Ar. accentuata* as the type, since the first three species were removed by Walckenaer to his new genus *Sparassus* in 1805 ('Tableau,' p. 39); and it involves the substitution of *Micromata* for *Anyphæna*.

In this case, again, I do not see how we are to get away from the facts, and must still regard as the type of *Micro-*

*mata*, *M. accentuata*, Walck. The only other course open is to adopt the usual attitude and sacrifice consistency in any case where an adherence to it involves some inconvenience. It is precisely this attitude which in nearly every branch of systematic zoology has led to the present chaos in nomenclature.

As to whether Walckenaer, according to Dahl's contention, would have divided *Micromata* into three parts if he had not meant to exclude *accentuata* from it, does not influence the position at all. It was not for Walckenaer to decide what should or should not be included in Latreille's original generic group; that was already irrevocably settled. What he did do was to remove three species and leave in one, which happened to be *accentuata*.

Type, *M. accentuata*, Walck.

*Walckenaer's Genera founded in the 'Tableau  
des Aranéides,' 1805.*

OLETERA, Walckenaer, Tableau, p. 7 (1805).

A single species only, with synonyms, is referred to this genus, namely *O. difforme* (*O. atypus*)—*Ar. picea*, Sulzer, Ab. Gesch. Ins. pl. 30. fig. 2; Römer, pl. 30. fig. 2, *Ar. subterranea*.

If all these represent one and the same species, then this genus is congeneric with *Atypus*. Since no type has been selected, I here cite *Ar. picea*, Sulzer, as the type.

Type, *Oletera picea* (Sulzer), 1776.—Europe.

MISSULENA, Walckenaer, Tableau, p. 8 (1805).

One species only, *M. occatoria*, New Holland, was originally referred to this genus. This, sec. Simon, is the specimen on which, at that time unnamed, Latreille founded the genus *Eriodon*. *Eriodon* is thus a "nomen nudum," and its place is taken by *Missulena*.

Type, *Missulena occatoria*, Walckenaer, 1805.—New Holland.

CTENUS, Walckenaer, Tableau, p. 18 (1805).

One species only, *Ct. dubius*, is referred to this genus, and therefore serves as its type.

Type, *Ctenus dubius*, Walckenaer, 1805.—Cayenne.

SPHASUS, Walckenaer, Tableau, p. 19 (1805).

Five species were originally referred to this genus: (1) *indicus*, East Indies; (2) *heterophthalmus*, Latr.; (3)



*transalpinus*, Italy; (4) *fossanus*, Bosc, manuscript, L'araignées de Caroline, pl. 5. fig. i; (5) *timorianus*, Timor.

Of these, *heterophthalmus* had already been referred in 1804 to *Oxyopes* by Latreille, and, being the sole species, remains as its type. Of the rest all are probably congeneric with this and with each other; but *indicus* is here selected as the type of *Sphasus*, none having either been definitely selected or left in by elimination.

Type, *Sphasus indicus*, Walckenaer, 1805.—East Indies.

**ERESUS**, Walckenaer, Tableau, p. 21 (1805).

Two species were originally included in this genus:—(1) *Er. cinnaberinus*, Olivier, Encycl. Méth. t. iv. p. 221, no. 85; (2) *Er. ater*, Walck.

In 1810 Latreille selected "*Araignée rouge*," Olivier, as the type. This species is *A. cinnaberinus*, Olivier, and was also selected as the type by Thorell in 1869–70.

If, as Simon supposes (Hist. Nat. Ar. (2) i. p. 254), this species be identical with *Aranea nigra*, Petagna (Specim. Ins. ulter. Calabriae, 1787, p. 34), the latter name has priority, and the species was selected under this name as the type by Simon (*loc. cit.*).

Type, *Eresus cinnaberinus* (Olivier), 1789, = ? *Eresus niger* (Patagna), 1787.—Europe.

**ATTUS**, Walckenaer, Tableau, p. 22 (1805).

There are forty-seven species originally included in the genus, namely:—*morsitans*, *locusta*, *gerbillus*, *galathea*, *annulatus*, *oppositus*, *observans*, *contemplator*, *excubitor*, *fulvatus*, *trilineatus*, *elegans*, *pubescens*, *chalybeius*, *scenicus*, *psyllus*, *cupreus*, *coronatus*, *virgulatus*, *nidicolens*, *frontalis*, *lunulatus*, *bicolor*, *callidus*, *niger*, *tripunctatus*, *litteratus*, *muscorum*, *sanguinolentus*, *quinque-partitus*, *crucigerus*, *auratus*, *splendidus*, *chrysis*, *tardigradus*, *pomatius*, *undatus*, *fossilis*, *formicarius*, *parallelus*, *encarpatus*, *x-notatus*, *pulverulosus*, *nivosus*, *caudefactus*, *variegatus*, *depressus*.

Of these 47 species originally included under this genus, *A. scenicus* was removed in 1810 by Latreille as the type of *Salticus*. In 1833 Sundevall, as Thorell points out, separated the two genera and selected *A. formicarius* as the type of *Salticus*, which he had no power to do at that date. He also gives under *Attus* six sections, quoting one or more species and often selecting the type of a section; but he was not in any sense breaking up the original genus *Attus*, for he made no new genera, nor did he in any sense limit the

genus to the species he quotes, nor can any of the types selected for any of the sections be regarded as a type selected for the genus itself.

C. L. Koch, in *Deutsch. Ins.* 119.3.4, 1833, quotes under *Attus* two species, *A. terebratus*, Clerck, and *A. pubescens* (Aran. F.), and in the same place and at the same time he makes a new genus, *Heliophanus*, 119.1.2, 1833, giving *H. cupreus*, Wlk., as the sole representative. This action must, if we follow our principles of elimination, be regarded as a first breaking up of the genus and limiting it to the two species quoted.

Thorell (*Europ. Spid.* p. 218) says, referring to the 'Uebersicht,' 1837:—"We have accordingly restored the generic name *Attus* to the spiders, which Koch *first* under that name detached from Walckenaer's *Attus*." Thorell's principle is that which is followed here; but 1837 was not the *first* occasion, for, as shown above, the first detachment took place by Koch in 1833.

Koch, however, in the place quoted by Thorell (*Uebersicht*, 1837, p. 32), further limits *Attus* to *pubescens*, adding *arcuatus*, Clerck, which, however, cannot serve as the type, since it does not occur in the *first limitation* of the genus.

*A. pubescens* is therefore the last species left in, and remains as the type.

Thorell, curiously enough, selects as the type *A. terebratus*, Clerck, a species which is not even mentioned in what he considered to be the *first detachment* from *Attus* by Koch. He does not, however, regard any of these as synonyms, for *arcuatus*, Clerck, *terebra*, Clerck, and *pubescens*, Fabr., are all (*Rem. Syn. Europ. Spid.*) regarded as distinct species.

Samouelle, '*Entomologist's Useful Compendium*,' 1819, p. 129, places *Aranea scenica*, Linn., under *Salticus*, and *Salticus formicarius*, Latr., under *Attus*, p. 130. In this work, however, no new genus is being formed out of the species left under *Attus*, and the act cannot be regarded as one of valid limitation or definite citing of types. The case furnishes a good illustration of the advisability of requiring some criterion as to the real systematic intentions of an author, such as that furnished by the fact of the formation of a new genus. We thus rid ourselves of the inconvenience of having to consult all kinds of trivial papers and works.

The name *Atta* is used by Fabricius for Hymenoptera in 1804, but *Attus* is here retained none the less for the Araneæ.

Type, *Attus pubescens*, Fabricius, 1775.—Europe.

THOMISUS, Walckenaer, Tableau, p. 28 (1805).

Out of the thirty-three species originally included in this genus—*canceridus*, *plagusius*, *rotundatus*, *Diana*, *truncatus*, *secatus*, *citreus*, *calycinus*, *fucatus*, *Dauci*, *delicatulus*, *tricuspidatus*, *litturatus*, *cristatus*, *onustus*, *floricolens*, *violaceus*, *rugosus*, *malacostraceus*, *pigrus*, *bilineatus*, *tigrinus*, *jejunus*, *aureolus*, *cespitolens*, *grapsus*, *pagurus*, *leucosia*, *pinnotheres*, *dispar*, *oblongus*, *argentatus*, *rhomboicus*—Latreille selected in 1810 (*"Araignée citron,"* De Geer) *Aranea levipes*, Linn., as the type.

This, however, according to our rules, he had no power to do, since he had already referred the same species to *Misumenina* as its sole representative in 1804. Neither could Walckenaer include *citreus* under *Thomisus*, since it was the type species of Latreille's earlier genus.

It is difficult to suppose that Latreille quoted *levipes*, Linn., in any other sense than as a synonym of *citreus*, for he would hardly have referred to two species, knowing them to be distinct, in a place where he is, by his own express statement, selecting "*l'espèce qui leur sert de type.*"

A. The genus was first broken up by Walckenaer himself in the '*Faune Française*,' August 7th, 1824, p. 86, where he founds his new genus *Philodromus*, including several of the original species, and limits those typical of *Thomisus* to fourteen species—*rotundatus*, *Diana*, *picatus*, *truncatus*, *onustus*, *cristatus*, *calycinus*, *Dauci*, *delicatulus*, *tricuspidatus*, *litturatus*, *floricolens*, *pigrus*, and *bilineatus*.

B. This group is again restricted by Simon in Hist. Nat. Ar. 1864, p. 432, where he withdraws *truncatus* under his new genus *Phlæoides*, and *rotundatus* under *Synema*, n. g. None of the original names are here placed under *Thomisus*.

C. It is again further limited by Simon in 1875 (Ar. Fr. ii. p. 251 &c.), where he withdraws *pigrus* and *bilineatus* under his new genus *Tmarus*, and restricts the genus to a single species of those originally included, namely, *onustus*, Walck., which thus becomes the type.

But Thorell, in 1870, had already selected *abbreviatus*, Walck., 1825,=*onustus*, Walck., 1805, as the type; and Simon, in Hist. Nat. Ar. ii. p. 1023 (1895), selected *albus*, Gmelin, 1788-93,=*onustus*, Walck. (sec. Simon), the former name having priority.

Type, *Thomisus onustus*, Walckenaer, 1805,=*T. albus* (Gmelin), 1788-93.—Europe.

SPARASSUS, Walckenaer, Tableau, p. 39 (1805).

Five species were originally included:—(1) *smaragdulus*, Fabr. & Clerck; (2) *roseus*, Clerck; (3) *ornatus*, Walck.; (4) *argelasius*, Walck.; (5) *pallens*, Fabr.

Of these, *argelasius* is a "nomen nudum," being published without a single line of description (*cf.* Simon, Ann. Soc. Ent. Fr. 1874, p. 261, "pas accompagné d'une seule ligne de description, il perd son droit de priorité"), and thus drops out of consideration for purposes of service as a type.

Of the other species, *smaragdulus* and *roseus* are identical with each other and also with *viridissimus*, De Geer.

We have left in therefore *viridissimus*, De Geer, *ornatus*, Walck., and *pallens*, Fabr.

Neither of these has been definitely cited as the type, for—

- (1) Latreille did not select any type for *Sparassus* in 1810.
- (2) Thorell, in 1870, selected *S. argelasi*, Walck., which was not available, being a "nomen nudum."
- (3) Simon, in 1897 (Hist. Nat. Ar. (2) ii. i. p. 47), selected *S. argelasius*, Latr., 1818, a species not originally referred to the genus.

It appears that one must select either *viridissimus*, *ornatus*, or *pallens*.

On the grounds that *Micromata* is already occupied with *accentuata* as type, I here select *viridissimus*, De Geer, which is congeneric with *ornata*, Walck.

If, however, we maintain the position that *viridissimus* is the type of *Micromata*, then *pallens*, Fabr., remains as the type of *Sparassus*. Having, however, no clue as to what *Ar. pallens*, Fabr. (Ins. Amer.), may be, we shall have to accept the identification by C. L. Koch for the time being as correct (Die Arach. iv. p. 82, fig. 304, 1837).

This species is, so far as one can judge, *Heteropoda venatoria*, Linn. (♂), = *regia*, Fabr., 1793; and since the name *pallens* was published in 1775, if these names indicate the same species, *pallens* will stand, and in this case *Sparassus* becomes a synonym of *Heteropoda*.

Type, *Sparassus viridissimus* (De Geer), 1778.—Europe.

DRASSUS, Walckenaer, Tableau, p. 45 (1805).

There are seven species altogether included originally by Walckenaer under this genus:—

- (1) *D. lucifugus* (Walck.), pl. v. figs. 46 & 47; Faun. Par. t. ii. p. 121. no. 69; Schæffer, Icon. pl. ci. fig. 7.



- (2) *D. nocturnus*, Linn.
- (3) *D. gnaphosus*, Walck. (esp. inédite).
- (4) *D. rubrens*, Walck. (esp. inédite).
- (5) *D. fulgens*, Walck.
- (6) *D. vasifer*, Bosc (*Ar. turcica*), Carolina, p. 5, pl. iv. fig. 2, MSS.
- (7) *D. viridissimus*, Walck. Faun. Par. t. ii. p. 212. no. 52.

So far as I can make out, there was no selection of any type nor any further breaking up of the genus between 1805 and 1810, when Latreille definitely selected *D. lucifugus*, Walck., as the type. Simon (Hist. Nat. Ar. ii. p. 383) attributes *lucifuga* to Latreille, though I am unable at present to find any grounds for this attitude; while Thorell quotes *quadripunctatus*, Linn., as the type.

Type, *Drassus lucifugus* (Walck.), 1802.—Europe.

AGELENA, Walckenaer, Tableau, p. 51 (1805).

Two species were originally referred to this genus:—  
(1) *A. labyrinthica*, Fabr.; (2) *A. nævia*, Wlk.

These species have never been referred to any other genus, though Latreille, in 1810, referred back the genera *Nyssus* and *Agelena* to *Aranea*, and selected *A. domestica*, Fabr., as the type of the latter, which, of course, at that date he had no power to do, having already limited *Aranea* to three species, which did not include *domestica*.

In 1869-70 Thorell selected the first as the type of the genus, which is also quoted by Simon (Hist. Nat. Ar. 2, ii. p. 258, 1898).

Type, *Agelena labyrinthica* (Clerck), 1757.—Europe.

NYSSUS, Walckenaer, Tableau, p. 52 (1805).

The only species referred to this genus is *N. coloripes*, Walck., New Holland or Notasia. Of this Simon says (Hist. Nat. Ar. 2, t. ii. p. 259, 1898, nota) that it is impossible to identify it with any certainty.

Type, *Nyssus coloripes*, Walckenaer, 1805.—New Holland.

EPEIRA, Walckenaer, Tableau, p. 53 (1805).

Sixty-four species were originally included in this genus. It was, so far as I can find, first limited by Audouin in Savigny's Hist. Egypte, ed. i. 1826 (sec. Sherborn, P. Z. S. 1897), when he withdrew *Epeira sericea* under his new genus *Argiope* (not *Argiope*, as in ed. 2, sec. Thorell and Simon), p. 121, to two species—*E. apoclisia* and *E. umbratica*, p. 128.

In this work the name *E. apoclisa* is definitely attached to a species which is obviously the *Ar. cornutus*, Clerck, and not *Ar. patagiatus*, Clerck (see Audouin's plate).

In 1864 Simon removed *E. umbratica* to his new genus *Nuctenea* in Hist. Nat. Ar. p. 261, leaving *E. apoclisa* in as the type. *E. apoclisa* was removed at the same time to *Neoscona*, but later, on the same page of the same work.

Type, *Epeira apoclisa*, Walckenaer, = *E. foliata* (Fourc.), 1785.—Europe.

**THERIDION**, Walckenaer, Tableau, p. 72 (1805).

Twenty-seven species were originally referred to this genus:—*lineatum*, *redimitum*, *ovatum*, 4-*punctatum*, *paykullianum*, *maculatum*, *peritum*, *variatum*, *sisiphum*, *nervosum*, *pictum*, *denticulatum*, *tinctum*, *pulchellum*, *carolinum*, *lepidum*, *venustum*, *crypticolens*, *triangulifer*, *punctatum*, *urticae*, *alveolus*, *obscurum*, *signatum*, *benignum*, *aphane*, *incertum*.

It was not, however, limited definitely in any way between the date of its establishment and 1810, when Latreille definitely selected *Ar. redimita*, Linn., as the type. This species is the same as *Ar. redimitus*, Clerck (p. 59), a variety of *Ar. lineatus*, Clerck (p. 60) and of *Ar. ovatus*, Clerck (p. 58), whose names, however, have been dropped.

Thorell (1869-70) quotes *T. sisypium* (Clerck) and Simon (1894, Hist. Nat. Ar. 2, i. p. 550) *T. lineatum* (Clerck) as the type.

Type, *Theridion redimitum* (Linn.), 1758.—Europe.

**PHOLCUS**, Walckenaer, Tableau, p. 80 (1805).

Three species were originally included, by name at any rate, under this genus:—(1) *Pholcus phalangoides*, Walck.; (2) *Aranea Pluchii*, Scop. Ent. Carn. 404, 1120; (3) *Ar. opilionides*, Schranck . . . 1783.

Another species was referred to as Geoff. t. ii. p. 651. no. 17, but no name is given to it, and it is therefore not available as the type.

In 1810 Latreille selected as the type "L'araignée domestique à longues pattes," Geoff., but without giving it a name.

In 1869, Nov. 13th, Thorell selects *Pluchii*, Scop. 1763, as the type, and Simon, Hist. Nat. Ar. 2, i. p. 471 (1893), quotes *phalangoides*, Fuessl. 1775, as the type (originally spelt *phalangoides*).

Latreille's selection cannot stand. Thorell gives *Pluchii*, Scop., as questionably = *phalangoides*, Fuessl.; Simon regards them as distinct species (Ar. Fr. i. pp. 259-261, 1874), and Thorell's earlier selection stands.

Type, *Pholcus Pluchii*, Scopoli, 1763.—Europe.

**LATRODECTUS**, Walckenaer, Tableau, p. 81 (1805).

Two species only are referred to this genus originally:—  
(1) *L. tredecim-guttatus*, Rossi, Italy; (2) *L. mactans*, Fabr.  
t. ii. p. 410, America.

In 1806 Latreille mentions this same species under Walckenaer's generic name, and in 1810 definitely selected it as the type of the genus.

Thorell (Nov. 13, 1869) and Simon (Oct. 10, 1894) both quote this same species as the type.

Type, *Latrodectus tredecim-guttatus* (Rossi), 1790.—Europe.

**STORENA**, Walckenaer, Tableau, p. 83 (1805).

A single species was originally referred to this genus—*Storena cyanea*, Walck., Nova Gallia—which remains as type.

Type, *Storena cyanea*, Walckenaer, 1805.—New South Wales.

**ULOBORUS**, Latreille, Gen. Crust. Ins. i. p. 109 (1806).

A single species was originally referred to this genus—*U. Walckenaerius*, Latr.—and was also quoted by Latreille as the type in 1810.

Type, *Uloborus Walckenaerius*, Latreille, 1806.—Europe.

**CLOTHO**, Walckenaer; published by Latreille in Gen. Crust. Ins. iv. p. 370 (1809).

A single species was originally referred to this genus—*Clotho Durandi*, Walck. In selecting the type in 1810 Latreille speaks of the species as *manuscrit communiqué*, so that he was simply editing Walckenaer's genus and species. The name *Clotho* was, however, preoccupied by St. Fonds for the Mollusca in 1808, and has since been superseded by the name *Uroctea*, Dufour, 1820.

Type, *Clotho Durandi*, Walckenaer, 1809.—Europe.

**EPISINUS**, Walckenaer; published by Latreille in Gen. Crust. Ins. iv. p. 371 (1809).

A single species was originally referred to this genus—*Episinus truncatus*, Walck., *Hab.* in Agro Taurinensis. In quoting this as the type in 1810 Latreille adds "*MS. communiqué*," so that both genus and species must be referred to Walckenaer.

Type, *Episinus truncatus*, Walckenaer, 1809.—Europe.

XLVIII.—*Descriptions of Fourteen new Species of Marine Mollusca from Japan.* By G. B. SOWERBY, F.L.S.

*Murex gallinago*, sp. n.

Testa subclavæformis, antice rostrata, postice conica, albida, transversim fulvo trifasciata; spira elata, acute conica; anfractus 7, convexi, spiraliter subacute lirati, longitudinaliter crassiplicati, trivariicosi, varicibus crassis elevatis rotundatis, hic illic brevissime spinosis; anfractus ultimus mediocriter convexus, varicibus inferne imbricato squamosis; rostrum elongatum, angustum, rectiusculum vel leviter recurvum; apertura rotunde ovalis, intus noduloso plicata; labrum acutum, crenulatum, columella tenuiter callosa.

Long. 49, maj. diam. 22 millim.

*Hab.* Hahajima Ogasawara.

An elegantly formed and delicately coloured shell, somewhat resembling, on a small scale, *M. malabaricus*, Smith, but with the longitudinal ribs or plications much stouter and less numerous. It bears also some resemblance to *M. rectirostris*, Sow., but the varices are not spinose, or at least scarcely perceptibly so. In the squamose rather than spinose character of the base of the varices the shell appears to have some affinity with those of the "*motacilla*" group.

*Pentadactylus japonicus*, sp. n.

Testa subangulatim ovata, utrinque acuminata, albida, violaceo tincta, rufo interruptim fasciata; spira acute conica; anfractus 6, angulati, spiraliter imbricatim lirati, ad angulum acute nodulosi, longitudinaliter costati, costis parum elevatis; anfractus ultimus dense squamoso liratus, obtuse biangulatus, infra attenuatus; apertura oblonga, intus pallide violacea, nodulis rotundatis 4-5 armata; labrum crenulatum, extus imbricatum, breviter spinosum; columella lævis, in medio leviter angulata, supra arcuata, infra oblique rectiuscula.

Long. 13, maj. diam. 9 millim.

*Hab.* Tanabe Kii.

The shells of this species vary considerably in form, some being less angular, narrower, and less prominently imbricated, while the prevailing colour is paler than in the type. Its nearest ally is probably *P. asper*, Lamk., to which, however, it bears no very close resemblance.

*Pentadactylus paucimaculatus*, sp. n.

Testa acuminato-ovata, alba, fusco maculata, et seriatim punctata; spira acuminata, acuta, gradata; anfractus  $7\frac{1}{2}$ , primi 3 laves,



rotundati, sequentes angulati, spiraliter obscurissime lirati, longitudinaliter costati, costis rotundatis, parum elevatis, ad angulum nodulosi, penultimus biangulatus; anfractus ultimus convexus, obtusissime angulatus, costis fere obsoletis, liris spiralibus 5 nodulosi instructus, basim versus contractus; apertura oblongo-ovata, intus pallide fusco tineta, plicato lirata; labrum acutum, columella rectiuscula, lævis, tenuiter callosa; canalis brevis, lævissime recurvus.

Long. 11, maj. diam. 5 millim.

*Hab.* Hachijojima Izu.

This little shell is distinguished by the peculiar angularity of the upper whorls. The large irregular brown blotches are principally located in the space between the angle and the suture. The surface of the shell between the ribs and nodules is rather smooth, exhibiting scarcely any sculpture. In the type specimen the nodules are only here and there spotted with brown, but some are more regularly spotted.

*Scalaria eusculpta*, sp. n.

Testa turrita, tenuis, alba, imperforata; spira elongato-acuminata; anfractus 11, convexi, primi 2 læves, cæteri spiraliter eximie lirati, costis circ. 16 reflexis, superne aculeatim productis instructi; anfractus ultimus brevis, rotundatus; apertura ovato-subcircularis; labrum extus reflexum.

Long. 18, maj. diam. 7 millim.

*Hab.* Hirado Higen.

A delicate elongately turreted species, with numerous thin reflexed ribs, which are aculeated near the suture. This is one of the few spirally lirate species of the group. The liræ are quite distinct, though not very prominent.

Having considered the arguments for the substitution of the name *Scala* for that of *Scalaria*, and especially the very interesting history given by Prof. W. H. Dall (Bull. Mus. Comp. Zool. xviii. no. 29, pt. 2, pp. 299-307), I am of opinion that of the two, the well-known name *Scalaria* has the best claim to recognition. I must certainly plead guilty to a charge of inconsistency, having myself somewhat inadvertently, and without due consideration, adopted the name *Scala*. There is no manner of doubt that, according to the strict laws of priority, the name *Cyclostoma* should be used for this genus; but it is generally agreed that the adoption of that name, which has so long been used for a group of operculate land-snails, would be too inconvenient and lead to much confusion. If, then, we allow that in such a case as this an exception to the rule may be admitted, I cannot see the propriety or utility of adopting the name given by

an unbinominal author (Klein) in preference to that which has been universally known and used for 100 years, *Scalaria*, Lamarck.

*Aclis bitæniata*, sp. n.

Testa elongata, angusta, albida, pallide fulvo late balteata, lineis rufo-fuscis bitæniata; spira turrita perelongata vix convexa; nucleus pellucidus, retrorsus; anfractus normales 9, planato-convexi, primi 1-2 læves, cæteri spiraliter anguste confertim sulcati, sutura obliqua distincte impressa sejuncti; anfractus ultimus  $\frac{1}{3}$  longitudinis testæ æquans, oblongus, ad basim rotundatus; apertura subovata, parva, antice rotundata, postice angustior, intus lævis, rufo-fusco bitæniata; labrum tenue; columella simplex, leviter sinistrorsum contorta.

Long.  $9\frac{1}{2}$ , diam. 2 millim.

*Hab.* Hirado Higen.

A very pretty little shell, coloured with two clearly defined linear bands on each whorl. The whorls, particularly the upper ones, are very obliquely coiled; with the exception of the apical ones they are finely, spirally grooved. The nucleus is small, pellucid, and, as in the genus *Turbonilla*, sinistral.

*Triforis abnormalis*, sp. n.

Testa dextrorsa, elongato-pyramidata, fusca; spira vix convexa, apice obtuso; anfractus 12, primi 2 obtuse rotundati, corrugati, cæteri supra planati, vix concavi, infra biangulati, undique longitudinaliter irregulariter rugose plicati, liris numerosis inæqualibus dense granosis spiraliter cingulati; anfractus ultimus  $\frac{1}{3}$  longitudinis testæ paulo superans, infra medium valde concavo-contractus; rostrum breve, tubiforme, leviter recurvum; apertura patula, intus fusca, margine columellari tenuiter elevato, leviter reflexo, dextro crenulato, ad canalem transcolumellam incurvo.

Long. 14, maj. diam. 5 millim.

*Hab.* Schizum Wakasa.

There can be little doubt that this is really a dextral species of *Triforis*. It is not very far removed from *T. perversus*, Linn., excepting in the inequality of the nodules and the prominence of the ridges below the middle of the whorls. The canal, as in most of the *Trifori* when adult, is separated by the outer lip passing over and almost uniting with the columellar margin.

*Nerita proxima*, sp. n.

Testa oblique ovata, fulva, nigro-fusco variegata, spira parva, abbreviato conica, convexa; anfractus 4 convexi, oblique sub-

tiliter striati, spiraliter valde lirati, liris numerosis, rotundatis; anfractus ultimus latus, obliquus, supra leviter concavus, deinde convexe rotundatus, liris circiter 25 inæqualibus, rotundatis instructus; apertura patula eximie plicata, luteo tincta; labrum acutum, crenulatum, margine dextro oblique descendens; area columellari albo callosa, nitens, leviter irregulariter rugosa, ad marginem tridentata.

Alt. 15, lat. 18 millim.

*Hab.* Loo Choo.

The shell somewhat resembles a small form of *N. undata*, Linn., the callosity being much less rugose.

*Omphalius comptus*, sp. n.

Testa late conica, subdepressa, profunde umbilicata, nigro-fusca rufo tincta, ad peripheriam et infra albo articulata, regione umbilicali alba; spira depresso conica, convexa; anfractus 5, convexo declives, minutissime suboblique striati, spiraliter densissime lirati, liris majoribus 5 rugosis; anfractus ultimus ad peripheriam angulatus, carinatus, ad basim leviter convexus, multiliratus; umbilicus profundus, mediocriter latus, infundibuliformis, intus albus, valde tricostatus; apertura subcircularis, intus margaritaceus, labrum crassiusculum, crenulatum.

Alt. 6, diam. 7 millim.

*Hab.* Loo Choo.

This shell differs considerably from all the known species of *Omphalius*, although it certainly seems to belong to that genus. It has some characters in common with *Clanculus plebejus*, Phil. The specimens vary in the depth of colour, and in the number and disposition of the white spots, which in the type are confined to the peripheral keel, but all are white in and round the umbilicus. The prominent ribs, so conspicuous in the umbilicus of the type specimen, are in some absent or covered with a callus.

*Minolia ornata*.

Testa conico-turbinata, late et profunde umbilicata, alba, fusco maculata; spira elatiuscula, gradata; anfractus  $5\frac{1}{2}$ , primi 3 convexi, spiraliter lirati, cæteri superne angulati, longitudinaliter filo-striati, ad angulum carinati, supra angulum complanati, infra leviter convexi, maculis inæqualibus flammiformibus ornati; anfractus ultimus biangulatus, infra peripheriam maculis regularibus triangularibus ornatus, ad basim convexus; umbilicus subcircularis, eximie plicatus, spiraliter liratus; apertura subcircularis, peristoma simplex. Operculum tenue, corneum.

Alt. 4, lat.  $3\frac{1}{2}$  millim.

*Hab.* Hirado Higen.

This pretty little shell bears some resemblance to *Minolia strigata*, mihi, from which, however, it differs very considerably in detail. The angles are less numerous and less prominent, the longitudinal striæ are much more distinct, the umbilicus is wider and decussately crenulated within and on the border.

*Ethalia floccata*, sp. n.

Testa depresso conica, solidiuscula, polita, late et profunde umbilicata, albida, lineis fuscis numerosis obliquis et angulatis maculisque fuscis et albis picta; spira paulo elevata, convexiuscula; anfractus 5, leviter convexi, læves, sutura impressa sejuncti; anfractus ultimus ad peripheriam obtuse angulatus, ad basim convexus; umbilicus latus, plicatus, intus obtuse angulatus; apertura oblique subquadrata, intus argentea, peristoma simplex, callo columellari angustiusculo superne effuso.

Alt. 4, lat. 8 millim.

*Hab.* Yakujima Osumi.

This pretty shell has somewhat the form of *E. carneolata*, Melv., but more angular, and with a wider open umbilicus. It is smooth, with only the faintest trace of obsolete spiral liræ; the colour-markings are characteristic, consisting of oblique and acutely angulated brown lines running from the suture and brown spots in the middle of the whorls and at the periphery, while the base is rather curiously flaked with opaque white. The narrowness of the columella callus, scarcely overlapping the widely open umbilicus, seems to place this species on the confines of the genus.

*Tellina consanguinea*, sp. n.

Testa elongata, compressa, tenuiuscula, nitida, rosea, postice acuminata, leviter flexuosa, antice rotundata; umbones acuti; margo dorsalis anticus longus, vix declivis, posticis brevior, triangulatus, area angusta, acute lirata; valva dextra concentrica et radiatim tenuissime striato-sulcatim decussata, striis radiantibus posticis conspicuis, anticis obsoletis; valva sinistra undique lævior.

Alt. (umbono-marg.) 22, lat. (antero-post.) 52, diam. 8 millim.

*Hab.* Hirado Higen.

This shell bears some resemblance to *T. vulsellæ*, Chemnitz, from which it differs chiefly in its less attenuated form, shorter beak, and somewhat more solid substance.

*Cardita abbreviata*, sp. n.

Testa subcordata, crassiuscula, leviter inflata, pallide straminea, radiatim costata, costis 16 rugosis, crassis, confertis; umbones



incurvati, paulo ante medium locati, approximati; margo dorsalis anticus valde declivis, leviter concavus, posticus convexus, area ligamenti angusta. Pagina interna alba, ad marginem crenulata, duplicata; cardo normalis.

Alt. (umbono-marg.) 8, lat. (antero-post.) 9, diam. 6 millim.

*Hab.* Hirado Higen.

Somewhat resembling a small specimen of the Tasmanian *C. Gunni*, Desh., but the ribs are broader, less numerous, and with narrower interstices.

*Felania minor*, sp. n.

Testa cordato-ovata, compressiuscula, paulo altiore quam lata, pallida, nitens, leviter concentrice striata; umbones prominentes, acuti, leviter incurvati; margo dorsalis utrinque valde declivis, lunula nulla, ligamentum parvum. Pagina interna albo irregulariter fasciata, ad marginem lævis; impressiones musculares elongati, linea pallii haud sinuata; cardo dentibus centralibus duobus, unus bifidus in utraque valva, munitus.

Alt.  $4\frac{1}{2}$ , lat. 4 millim.

*Hab.* Hirado Higen.

A shell somewhat resembling *F. sericata*, Reeve, on a small scale.

*Pectunculus mundus*, sp. n.

Testa oblique suborbicularis, depressiuscula, albida, maculis fuscis paucis sæpe angularibus picta, concentrice sulcata, radiatim costata, costis planulatis latiusculis confertissimis, superne subgranulosis, interstitiis angustissimis; umbones prominentes, approximati; area ligamenti brevis, angustissima. Pagina interna obscure radiatim lirata ad marginem crenulata; cardo normalis.

Alt. 11, lat.  $11\frac{1}{2}$  millim.

*Hab.* Hirado Higen.

This pretty little species is allied to *P. pectinatus*, Lamk., and *P. pallium* and *morum*, Reeve. The radiating ribs are peculiarly flat, and the spaces between them very narrow.

XLIX.—Three new Species of Nyctinomus.

By OLDFIELD THOMAS.

*Nyctinomus fulminans*, sp. n.

General characters of *N. africanus*, Dobs., but with whitish belly and conspicuously smaller skull.

Size large, though rather smaller than in *africanus*. Ears  
*Ann. & Mag. N. Hist.* Ser. 7. Vol. xii. 33

large, evenly rounded, rising from the same spot on the muzzle; their anterior edge with four or five minute and inconspicuous warts; their keel moderately developed, not broadened or folded externally; antitragus as in *africanus*; tragus large, quadrangular, with rounded corners; a small angular projection present halfway down its outer margin. Wings to the ankles. Callosity at base of thumb unusually large. No gular sac.

Colour of body above dark chestnut-brown; below brown laterally, the median area of throat, chest, and belly white. Wings and interfemoral membrane above brown, below white, becoming rather browner distally.

Skull smaller and conspicuously narrower than in *N. africanus*. A median crest developed along parietal suture, more developed than in *africanus*, but disappearing on interparietal, where the bone is smooth and transparent. Anteorbital and mastoid projections comparatively little developed. Pre-maxillæ incomplete mesially. Incisors  $\frac{2}{4}$ . Anterior upper premolar small, in the general line of the tooth-row.

Dimensions of the type (measured in spirit):—

Forearm 60 millim.

Head and body 80; tail 53; ear 22; tragus on outer edge 7, breadth 4; height of antitragus behind 4; diameter of pollical callosity 3·2; third finger, metacarpal 57, first phalanx 25, second phalanx 21; fifth finger, metacarpal 32, first phalanx 15, second phalanx 7; lower leg and foot (s. u.) 28.

Skull: greatest length 22·5; basal length in middle line 17·7; zygomatic breadth 14; anteorbital breadth 8·5; inter-orbital constriction 4·7; mastoid breadth 13·2; front of canine to back of  $m^3$  8·8; front of lower canine to back of  $m_3$  10.

*Hab.* Fianarantsoa, E. Betsileo, Madagascar.

*Type.* Male. B.M. no. 82. 3. 1. 34. Collected by the Rev. W. Deans Cowan.

This is the "rather smaller, white-bellied, and light-winged form" of *N. africanus* referred to in Mr. de Winton's paper on the group\*. It is, I think, fully distinct enough to be separated specifically, as the skull-differences are very strongly marked, in addition to those of colour and locality.

### *Nyctinomus cisturus*, sp. n.

A medium-sized species, with imperfect premaxillæ, united ears, and a peculiar swollen gland at the base of the tail.

\* Ann. & Mag. Nat. Hist. (7) vii. p. 37 (1901).

Ears thin, united at their bases, but not forming a prominent folded lobe at their junction; their anterior edge evenly but slightly convex, not folded back, without minute warts; tip broadly rounded off; outer edge strongly convex; antitragus high, broadly triangular; keel low, not flattened or thickened externally; tragus minute, triangular. Lips with vertical wrinkles. Apparently no gular sac. Pad at base of thumb not specially large. Wings to the distal third of the tibiæ, on their inner aspect. Tail involved in membrane for about three fifths of its length; at its base, on the upper surface, occupying the middle of the interfemoral area, there is a large glandular swelling, 8 millim. long by 6 broad, covered with fine fur; this swelling is caused by the presence of a pair of glands, presumably of a scent-secreting nature, which open on the under surface of the interfemoral by two large mouths, each over 3 millim. in length, placed diagonally on the two sides of the tail some 5 millim. behind the anus; the area round these mouths well covered with fine silky white hair; internally some sort of dark-coloured glandular secretion is present.

Colour above chocolate-brown, rather paler below, the tips of the belly-hairs greyish. Wings and interfemoral membranes above brown, below brown outside of the elbow, white near the body and on the interfemoral.

Skull rather small in proportion, smoothly rounded, a low median crest present running from the level of the intertemporal constriction to the occiput. Premaxillæ imperfect mesially, but the opening between them unusually small.

Incisors  $\frac{2}{4}$ , the upper slender, not far apart, nearly parallel. Anterior upper premolar small but not crowded, standing in the line of the tooth-row, its conical point higher than the cingula of the neighbouring teeth.

Dimensions of the type (measured in the flesh):—

Forearm 47 millim.

Head and body 63; tail 35; ear 15; tragus 1.3; height of antitragus 2.2; third finger, metacarpal 46, first phalanx 19, second phalanx 18; fifth finger, metacarpal 27, first phalanx 14, second phalanx 5; lower leg and foot (s. u.) 24.

Skull: greatest length 18.1; basal length in middle line 13.8; zygomatic breadth 11.2; anteorbital breadth 6.5; constriction 3.7; mastoid breadth 10.3; front of canine to back of  $m^3$  6.8; front of lower canine to back of  $m_3$  7.1.

*Hab.* Mangala, on the east bank of the Nile, 25 miles N. of Gondokoro.

*Type.* Adult male. B.M. no. 2. 7. 4. 4. Original number 2805. Collected and presented by W. L. S. Loat, Esq.

This bat differs from all known members of the genus by its possession of the unique caudal gland above described. In other respects it is a true *Nyctinomus*, belonging to the typical group with imperfect premaxillæ.

*Nyctinomus demonstrator*, sp. n.

A medium-sized thick-set species with united premaxillæ, conjoined ears, and small scent-glands on each side of the penis.

Ears rather small, rounded, united at their inner bases for a height of about 2·5 millim., but without any folded lobe: keel slightly thickened in lower third; antitragus higher than long, rounded above, with a broad base; tragus minute, broader above than below, with an incurved upper angle and concave anterior margin. Lips wrinkled. No gular sac. Pad at base of thumb rather small. Wings to the distal third of the tibia. Tail involved in membrane for about half its length. Penis unusually short, or at least appearing short, as it projects by its tip only from the swollen mass of a pair of scent-glands surrounding its base, their two openings separated by a narrow septum situated halfway along the penis on its lower surface.

Fur very short and close, that on the forehead behind the junction of the ears appearing to be suffused with some oily secretion.

Colour dark brown above, more blackish on head; below also brown, the median area more greyish brown. Wing-membranes brown above and below; interfemoral membrane brown above, whitish below.

Skull low, stout and strong; brain-case small; muzzle narrow. Median crest not developed except in the interorbital region; premaxillæ united round the small palatine foramina. Upper incisors long, straight, almost parallel, not far apart; lower incisors four, bilobate, the outer pair rather smaller than the inner; anterior upper premolar present, but exceedingly minute, placed in the outer angle between the canine and large premolar, which touch one another.

Dimensions of the type (measured in spirit):—

Forearm 44 millim.

Head and body 64; tail 32; ear 17; tragus 2·0; height of antitragus 3; third finger, metacarpus 43, first phalanx 18, second phalanx 18; fifth finger, metacarpus 27, first phalanx 12·4, second phalanx 5; lower leg and foot (s. u.) 22.

Skull: greatest length 19·7; basal length in middle line 15·8; zygomatic breadth 12·7; anteorbital breadth 7; con-



striction 3·8; mastoid breadth 11·6; front of canine to back of  $m^3$  7·5; front of lower canine to back of  $m_3$  8·5.

*Hab.* Mangala, N. of Gondokoro.

*Type.* Adult male. B.M. no. 2. 7. 4. 3. Collected and presented by W. L. S. Loat, Esq.

I cannot find any known species to which this *Nyctinomus* can be assigned. None of Heuglin's show any relation to it, even apart from the peculiar gland above described, which he might have overlooked. It is curious that the two Mangala species should each be distinguished by a glandular structure unique of its kind.

#### L.—Notes on Irish Species of Eylais.

By J. N. HALBERT.

PREVIOUS to the publication of Dr. Koenike's paper on *Eylais* \* in 1897 only a single species—*E. extendens*, Müller—was recognized by zoologists; but it was apparent that the genus contained many type forms differing from one another quite as much as those of *Hydrachna*. Several papers on *Eylais* have since been published, containing descriptions of new species, so that the genus now promises to outnumber in species most genera of water-mites.

Many of the large red mites which may be commonly found during the summer months amongst plants growing in stagnant or slowly flowing water are referable to species of *Eylais*. In size they are the giants of the Hydrachnidæ, often reaching 5 or 6 millimetres in length.

Perhaps the most notable characteristics of this genus are, in the first place, the structure of the eye-plates, the four lenses of which are grouped together on a chitinous plate placed anteriorly in the middle line of the body, and the peculiar way in which these mites swim. Only the first three pairs of legs are then brought into play; the fourth pair, being without the long swimming-hairs, are trailed in an extended position, rather suggestive of a pair of rudders, while the animal swims.

The species of *Eylais* are very similar in general shape. The specific characters are founded on the comparative structure of the hard chitinous parts of the body, especially of the eye-plates, mouth-organs, and palps. All of these characters vary more or less in the same species, so that it is

\* 1897, Koenike, "Zur Systematik der Gattung *Eylais*, Latreille," Abh. Ver. Bremen, Bd. xiv. pp. 279-295.

often difficult to distinguish type forms from the numerous varieties and aberrations which may be grouped around them. As in other freshwater groups, many of the species are widely distributed.

Records of some of the English species have been published by Mr. C. D. Soar \*, and I have to thank that gentleman for the loan of types; also Dr. Sig Thor; and especially Dr. F. Koenike for his kindness in sending a number of valuable type species for comparison. Messrs. C. W. Buckle, G. P. Farran, W. F. de V. Kane, S. W. Kemp, H. L. Orr, and M. S. D. Westropp have kindly assisted me in collecting specimens.

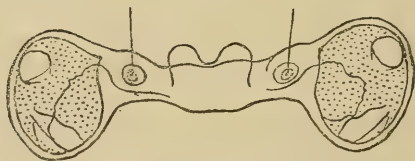
In the following pages twelve species of *Eylais* are enumerated, nine of which are referable to known forms, while the remaining three are described as new; also two varieties.

*Eylais hamata*, Koen.

1897. Abh. Ver. Bremen, Bd. xiv. pp. 282, 295, fig. 1.

This species is remarkable for the great length of the eye-plate and the relatively small size of the capsules. The prevalent Irish form has the chitinous bridge connecting the latter either straight or more or less bent backwards, and shows no trace of the marginal prominences figured by Piersig (Deutschl. Hydrach. pl. xlviii. fig. 168 *d*). However, I have seen Dr. Koenike's mounted types † of this species, and have no hesitation in recording the Irish mite as above.

Fig. 1.



The eye-plate ‡ of an aberration of this species is figured (fig. 1). In this specimen a chitinous process springs from

\* 1900, Soar, C. D., "British Freshwater Mites," 'Science Gossip,' vol. vii. (n. s.) pp. 203, 204, figs. 1-3; 1901, id. ib. vol. viii. (n. s.) pp. 68-70, figs. 1-8.

† Dr. Koenike's slide contains dissections of two specimens: one has the pointed prominences on the front of the eye-plate, the other is without these, agreeing with the Irish form in every respect. There can be no doubt that these two forms belong to the same species, as they otherwise agree in structure.

‡ With the exception of figure 9 ( $\times 72$ ) all the accompanying figures of eye-plates are drawn to the same magnification ( $\times 94$ ). As they are taken from Canada balsam mounts, an allowance should be made for alterations in the outline of the delicate lenses caused by the pressure of the cover-glass.

the middle of the underside of the bridge, and projects beyond the front margin in the shape of two round humps, one on each side of the middle line. This process serves for a muscle-attachment, such as may be found occasionally in most species; it is of no importance as a specific character.

Evidently a widespread species. I have taken it commonly in the Royal Canal, Portmarnock Ponds, and in other places near Dublin; in the River Barrow; and in brackish water on the coast of County Wexford.

*Eylais Koenikei*, sp. n.

This species bears some resemblance to *E. falcata*, Koenike, but differs considerably in the details of its structure.

Length about 3 millim.; the body is more rotund and less depressed than is usual in this genus. The eye-plate (fig. 2)

Fig. 2.

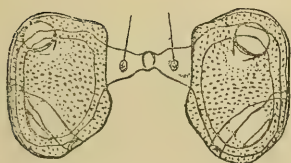
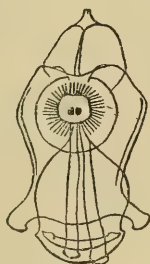


Fig. 2 a.



measures .40 millim. across at the widest part, length of single capsule .21 millim. The eye-capsules are roughly quadrate in outline, covered with large rather diamond-shaped markings; anterior and outer margins weakly rounded, inner margin distinctly emarginate, swollen posteriorly. Bridge\* connecting the eye-capsules very slender, becoming gradually narrower towards the middle, where there is a small oval muscle-attachment; about midway between this and the capsule on each side there is a hair-papilla.

The capitulum (fig. 2 a) measures about .60 millim. along the middle line of the maxillary plate; viewed from the front the lateral and distal margins are moderately emarginate; the latter is curved outwards in the centre, not joined

\* The position of the bridge evidently varies; in a less developed specimen it is nearer the front margin of the eye-capsules, and the hair-papillae are closer to the latter. The posterior lens also is of the usual oblong shape.

with the pharynx. The lateral processes stand out rather abruptly from the sides, slightly recurved at the inner angles. The pharynx is broad and strongly rounded at the sides; air-tubes about as long as the pharynx.

The palps are rather long and slender, measuring about 1.26 millim. in length. Second segment\* with 4 or 5 weakly feathered spines along the distal margin. Third with 7 or 8 short stout spines on the distal corner, one or two of the innermost of these distinctly feathered. Fourth with about 10 long spines towards the inner margin; six of these are arranged more or less in pairs.

*Locality.* Collected by Mr. H. L. Orr in Lough Gullion, County Armagh, May 1901.

*Eylais Koenikei* may be compared with the North-American species *E. falcata*, Koen. The bridge connecting the eye-plates is much longer and narrower in the Irish species. Another difference is in the position of the hair-papillæ, which in *falcata* are situated on the inner corner of the eye-capsules, not on the bridge. In *falcata* also the pharynx is of a regular long oval shape, quite unlike that of *E. Koenikei*.

*Eylais extendens* (Müller).

1776. Müller, O. F., Zool. Dan. Prodr. p. 190. no. 2272.

The species figured† by Piersig as the type of *E. extendens* (Müller) occurs in Ireland, although it is not by any means the commonest species found there. The eye-plate varies chiefly in the depth of the posterior emargination, also in the outline of the anterior margin, which may be quite straight, or with a marked indentation in the centre.

*Eylais symmetrica*, sp. n.

A large species, measuring about 4 millim. in length.

The eye-plate (fig. 3) is very large and of a marked type of structure, rather resembling that of *E. perincisa*, Ribaga; greatest breadth across .51 millim., length of single capsule .30 millim. Anterior margin of the bridge with an evenly rounded hump on each side of the middle line, divided by a sharply pointed rather deep indentation; muscle-attachment large and circular, with or without a long chitinous process. Posterior emargination very deep, equalling two thirds the

\* Throughout these descriptions the spines clothing the inner surface of the palps are alone referred to, as in this respect the inner surface is always the most characteristic.

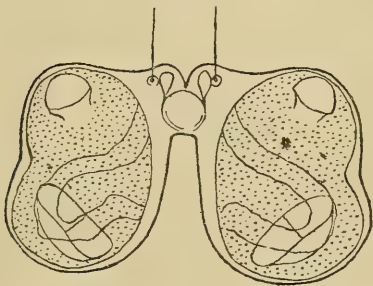
† 1900, Deutschlands Hydrachniden, pl. xlviii. figs. 119 a-h.



length of the eye-capsules; the latter are kidney-shaped, with large lenses.

In lateral view the sides of the capitulum are very deeply emarginate, with long side-processes; these do not project much beyond the distal margin, which is therefore but

Fig. 3.



moderately emarginate. Palps long; length of the three terminal segments  $\cdot 25$ ,  $\cdot 46$ , and  $\cdot 18$  millim. respectively; inner corner of third segment with about 10 short stout spines, a few distinctly feathered. Fourth segment with about 4 long spines near the inner margin, which is well developed, and a group of 6 shorter strongly feathered spines close to the distal margin.

*Locality.* Found in brackish water on the coast of County Wexford.

*Eylais neglecta*, Sig Thor.

1899. Arch. Naturv. Christian. vol. xxi. p. 12, pl. xvii. figs. 156-158.

A form resembling this species occurs in Ireland. The group to which it belongs is an extremely difficult one to differentiate with any degree of certainty. I have taken specimens approaching very closely to *E. similis*, Thon, *E. tenera*, Thon, *E. rimosa*, Piersig, &c., in the structure of the eye-plates. Owing, however, to the great variation which occurs, I should prefer to treat these Irish specimens as varieties or aberrations of the same species.

*Eylais undulosa*, Koenike.

1897. Abh. Ver. Bremen, Bd. xiv. pp. 283, 295, fig. 2.

This is certainly an Irish species; specimens taken in the Royal Canal, near Dublin, agree very well with the types

lent by Dr. Koenike. In the Irish examples the inner corner of the third palp-segment is rather well developed, with from 12 to 14 short stout spines, *none* of which are feathered.

*Eylais Soari*, Piersig.

1899. Zool. Anzeiger, Bd. xxii. p. 67, fig. 8.

The type form of this species occurs but rarely; the prevalent form found here should, I think, be referred to a distinct race or variety of *E. Soari*.

*instabilis*, var. n.

My specimens of this variety agree in size with those described by Dr. Piersig, ranging from 3 to 4 millim. in length; yet the eye-plate and palps are uniformly larger, and there are other differences in structure.

The eye-plate (figs. 4 and 5) measures from .45 to .48 millim. across, length of capsule about .25 millim., of more

Fig. 4.

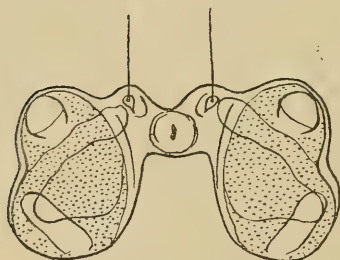
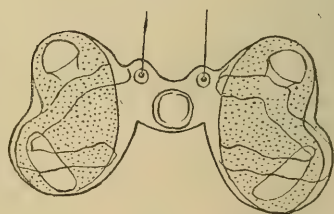


Fig. 5.



robust structure than in the type. Bridge somewhat longer and broader, with the posterior emargination either round or more or less sharply angled.

The capitulum measures about .66 millim. from the front margin of the maxillary plate to end of pharynx; the type of structure greatly resembles that of *E. Mülleri*, Koenike (Deutschl. Hydrach. pl. xlviii. fig. 153 a). The palps are robustly built, length about 1.20 millim. Inner corner of third segment well developed, with from 14 to 18 short stout spines, the innermost ones weakly feathered. Fourth segment strongly swollen on the inner margin, near which there are about 6 long spines, and the usual group of 4 or 5 strongly feathered spines close to the distal margin.

*Localities.* Common in quarry holes near Crumlin and

Raheny, Grand Canal near Dublin, also in Lough Gur, Co. Limerick.

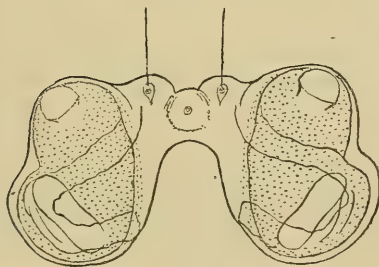
This variety is closely allied to *E. variabilis*, Sig Thor, recently described from Norway. Here, again, the uniformly larger size of the eye-plate obtains. In *variabilis* the inner corner of the third palp-segment bears fewer, longer, and more distinctly feathered spines.

*Eylais triarcuata*, Piersig.

1899. Zool. Anzeiger, Bd. xxii. p. 66, fig. 7.

An *Eylais* closely resembling this species occurs rather commonly near Dublin and elsewhere in Ireland. In these specimens the central muscle-attachment invariably overreaches the front margin of the eye-plate, but not so prominently as in Piersig's figure. As this is a very unsatisfactory character, it may be best to record this species with reserve. The eye-plate (fig. 6) varies greatly in outline, and, as usual,

Fig. 6.



the posterior emargination may be truncate or evenly rounded. The capitulum also varies, and resembles that of *Eylais Mülleri* in structure. On the inner corner of the third palp-segment there are usually from 14 to 16 short spines, some of these are feathered.

Perhaps this Irish form should be referred to a variety of the North-American species *E. triangulifera*, Koenike, of which I have seen the types. So far as the eye-plates are concerned, the differences are slight.

*Eylais unisinuata*, Croneberg.

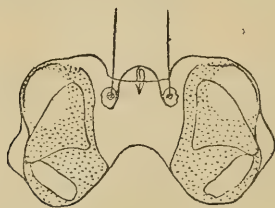
1902. Bull. Imp. Moscou, p. 98, figs. 9 a-c.

Last June I took this species in some numbers in the

River Corrib, near Galway. The following is a short description based on these specimens:—

The eye-plate is of medium size ( $\cdot38 \times \cdot20$  millim.). In the type form the anterior margin is shallowly emarginate in the centre; posterior emargination deep and truncate. The outline, however, is very variable; one of the most marked aberrations is shown in fig. 7. A notable point is the strong

Fig. 7.



sinuation of both the inner and outer margins of the eye-capsules. Central muscle-attachment large, semicircular in shape, reaching as far as or beyond the anterior margin.

The capitulum measures  $\cdot75$  millim. from the apex of the mandibles to end of pharynx; length of maxillary plate  $\cdot46$  millim., rather deeply emarginate distally and curved outwards at the centre; lateral processes directed downwards, variable in length. Pharynx relatively broad ( $\cdot23$  millim.), sinuate on each side near the apex.

The palps are rather long ( $1\cdot40$  millim.); second segment with four spines towards the inner end of the distal margin; third with the inner corner moderately developed, with 8 or 9 stout spines; some of these are feathered.

*Eylais spinipons*, Sig Thor.

1897. Arch. Natury. Christian. vol. xx. p. 9.

1899. Ibid. vol. xxi. pl. xvii. fig. 164.

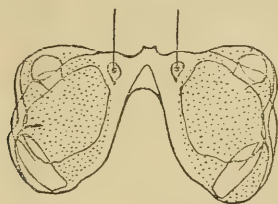
The eye-plate (fig. 8) measures about  $\cdot38$  millim. across, length  $\cdot23$  millim. Anterior margin relatively straight, produced at centre into a two-pointed prominence, much as in the type form of *infundibulifera*, Koenike; hinder emargination very deep and rounded. Capitulum short and broad, distal margin only moderately emarginate. Air-tubes shorter than the pharynx; the latter is narrow and of comparatively uniform breadth throughout.

Palps stoutly built; second segment with about 8 feathered spines along the distal margin; third with the inner corner



rather weakly developed, with from 12 to 14 rather slender feathered spines; fourth with very numerous spines grouped irregularly along the sinuate inner margin.

Fig. 8.



*Localities.* Fish Pond near Gorey, and at Enniscorthy, County Wexford; also in the Portmarnock Brickfields, near Dublin.

*Eylais infundibulifera*, Koenike.

1897. Abh. Ver. Bremen, Bd. xiv. pp. 284, 295, figs. 3, 4.

This is probably the commonest and most generally distributed species in Ireland. I have taken it at Lough Neagh; in the River Corrib, Galway; the Blackwater, Co. Cork; Lough Gur, Co. Limerick; and at various localities near Dublin.

The eye-plate of this species is subject to great variation. I have seen Dr. Koenike's type specimens, and, as he has himself clearly stated, there can be no doubt that this species is the same as *E. bifurca*, Piersig. Dr. Koenike's specimens agree excellently with the description and figures of the last-named species (Deutschl. Hydrach. pl. xli. figs. 120 a, b).

The following is a description of an *Eylais* which, although it differs very strikingly from the type form of *infundibulifera*, Koenike, should, I think, be referred to a variety of that species. It may be called

*stagnalis*, var. n.

The eye-plate (fig. 9) is very large, measuring about .50 millim. across, length of single capsule .30 millim. Anterior margin produced at centre in a narrow irregularly pointed process, the apex of which serves for a muscle-attachment; on each side of this the bridge is slightly undulate; posterior emargination broad, deep, and evenly rounded, leaving a chitinous bridge, varying from .05 to .10 millim. in

breadth, connecting the eye-capsules. The latter are sinuate on the outer margins, with large cup-shaped and oblong lenses. The lip of the opening on the underside of the eye-plate may be broad, as in figure, or very narrow, causing a great difference in outline.

The capitulum (fig. 9 a) measures about .63 millim. along

Fig. 9.

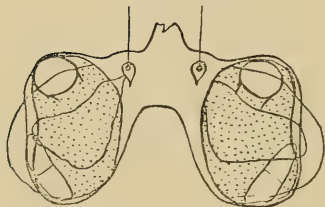
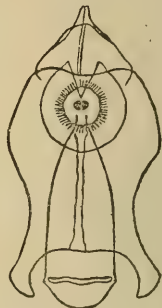


Fig. 9 a.



the middle line of the maxillary plate, somewhat deeply emarginate distally, with outwardly and downwardly directed lateral processes, the apices of which are recurved; the pharynx is relatively narrow and of very uniform breadth towards the apex; cuticular ring sinuate.

The palps are long (nearly 2 millim.) and heavily built, like those of *infundibulifera* in structure. Inner corner of second segment with 7 or 8 spines; a group of four of these is situated on the extreme inner corner. Third segment with about 18 comparatively long spines on and near the inner corner; most of these are strongly feathered, and there are 5 or 6 additional spines along the distal margin. Fourth segment clothed with very numerous bristles.

*Locality.* Portmarnock Brickfields, near Dublin, June 1899.

### *Eylais celtica*, sp. n.

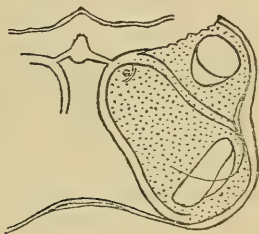
The type of this species measured about 4 millim. in length, very depressed in form, with relatively large epimeral plates.

In the structure of the eye-plate\* (fig. 10) allied to *E. hungarica*, Daday, but the anterior prominence is obtusely pointed in the centre, not tongue-like as in that species, and the eye-capsules are quite different in outline, being widest

\* In the type specimen the eye-plate was somewhat injured during mounting in balsam.

anteriorly. The anterior margin of the eye-plate extends in front of the eye-capsules, very obtusely pointed in the centre; posterior margin widely and very shallowly emarginate. Very characteristic is the small oval muscle-attachment, which is connected by a very narrow chitinous band with the

Fig. 10.



rim of the eye-capsules. The latter are notably wider in front than behind; sinuate on both the inner and outer margins; lenses large and of the usual shape.

The capitulum is broadly built, length of the maxillary plate about .58 millim. Seen from the front the lateral and distal margins are only moderately emarginate; side-processes short, curved sharply inwards at their apices. The pharynx greatly resembles that of *E. infundibulifera*, var. *stagnalis* (see fig. 9a) in outline. Air-tubes shorter than the pharynx.

The palps are about 1.75 millim. in length. Second segment with 4 or 5 feathered spines on the distal margin and a group of four more on the extreme inner corner. Third segment with about 20 long strongly feathered spines in the vicinity of the inner distal corner, which is moderately developed. Fourth with many long bristle-like hairs grouped towards the inner margin, becoming more numerous at the distal end of the segment, many feathered.

*Locality.* Found in Ballynahinch Lake, County Galway, by Mr. W. F. de V. Kane, June 1900.

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LI.—*Remarks upon the Morphology and Systematics of certain Chilognathous Diplopods.* By R. I. Pocock.

I.—ON THE TERMINOLOGY AND EVOLUTION OF THE GONOPODS AND OF THE PENIS.

THE modified appendages of the seventh segment in the males of the Helminthomorphous Diplopods are commonly spoken of as "pedes copulativi," "gonopods," or, more

simply, as "male genitalia." These terminologies, however, do not allow for the known structural and functional differences of the parts involved in the formation of the apparatus. This apparatus is exhibited in its simplest form in the Polydesmoidea, in which only the appendages of the anterior pair of the seventh segment are converted into organs which are furnished with a seminal pouch and duct and act as carriers of the sperm and as its transmitters into the genital apertures of the female. In the Iuloid, Spiroboloid, and Spirostreptoid Chilognatha both pairs of appendages and the two sterna of the seventh segment are modified as "gonopods," and combine to form an apparatus often of extreme complexity. But however complicated it be, its constituents are primarily resolvable into two parts, namely, the posterior appendage, bearing the seminal pouch and duct, and the anterior appendage, which forms a protective case or sheath for the former. The appendages bearing the seminal pouch and duct, whether they be the anterior or the posterior pair of the seventh segment, are the essential elements of the apparatus, and may be appropriately called the *phallopods*. The accessory appendages constituting the sheath may similarly be called the *coleopods*. Amongst existing Chilognaths the simplest types of gonopods of the compound kind are found in the Colobognatha, where both coleopods and phallopods are modified to a relatively slight extent. The phallopods are furnished apically with a tuft of bristles, but seem to be unprovided with seminal pouch and duct. It is probable that we have here a primitive condition in which this appendage was modified to hold a drop of sperm or a spermatophore—a purpose for which the arrow-headed bristles described by Brölemann in *Brachycybe Lecontei* and *Platydesmus guatemalensis* (Mém. Soc. Zool. Fr. 1900, pp. 109–113, pl. vii. figs. 76 & 82) seem well fitted. In any case, the physiological importance of these bristles is proved by the protection they receive from the modification as coleopods of the appendages in front of them.

It may be assumed that the formation of true phallopods with internal seminal sacs was preceded by a stage in which the appendages were simply modified as holders and inserters of spermatophores. In that case, from a stage of development a little earlier than that presented by the Colobognatha may be derived hypothetically along independent lines the condition of things found in the three sections of Chilognatha to which Verhoeff has given the names AscospERMOPHORA, Proterospermophora, and Opisthospermophora (Zool. Jahrb.,



Syst. xiii. pp. 53-54, 1900). In the Ascospermophora (Chordeumoidea) no seminal sacs have been developed within the appendages of the seventh segment, their function being performed (according to Verhoeff) by the exsertile coxal pouches of the two pairs of appendages of the eighth segment. Hence there are neither true phallopods nor coleopods. It is hard to believe that this condition has been derived from the advanced state seen in the other groups of Helminthomorpha, where genuine phallopods have been developed from the anterior or posterior pair of the seventh segment. In the Proterospermophora (Lysioptaloidea, Polydesmoidea) phallopods resulted from the transformation of the anterior pair of the seventh segment, the posterior pair reverting to the primitive type of locomotor appendage. In the Opisthospermophora they arose from the posterior pair, the anterior pair taking on the function of coleopods, the condition characteristic of both groups being derivable from the hypothetical stage in which both pairs of the appendages in question were modified simply as spermatophore-holders.

To the Opisthospermophora belong the Iuloidea, Spirostreptoidea (sens. lat.), Spiroboloidea, and no doubt also the Stemmiuloidea. Setting aside the Spiroboloidea, these groups further resemble each other in possessing a distinct penis. In the primitive Diplopod there were probably two penes emerging behind the appendages of the second pair. They are retained as such in the Limacomorpha. In the Colobognatha they are also distinct, although united to the coxæ of the appendages, being long in the Polyzonidæ, short in the Siphonophoridæ and Platydesmidæ, where they appear as papilliform excrescences of these segments. The fusion initiated in these families is carried to an extreme in the Chordeumoidea, Lysioptaloidea, Polydesmoidea, and Oniscoomorpha, where the penes have disappeared as independent structures, the seminal ducts perforating the coxæ of the appendages in question. In the Iuloidea and Spirostreptoidea the two penes have fused together, though the organ still shows unmistakable traces of its double origin. In the Stemmiuloidea the fusion is much more complete, all indications of the primitive double nature of the organ having disappeared, the process resulting in the formation of a long apparently bisegmented organ. The total suppression of the penis in the Spiroboloidea may be regarded as a specialized feature probably resulting from a gradual diminution in size of the small double penis such as is seen in the Spirostreptoidea. Thus it is possible to trace back all the modifications

of the penis as well as of the gonopods to a condition not very far removed antecedently from that which still persists in the Colobognatha, the condition seen in the Opisthospermophora having been evolved along one line, that seen in the Proterospermophora along another, that of the Ascospermophora along a third.

## II.—DESCRIPTIONS OF NEW FORMS.

### CHORDEUMOIDEA.

#### Genus HUTTONIELLA, nov.

Resembling the two Oriental genera *Heterochordeuma*, Poc., and *Pocockia*, Silv., in possessing thirty-two segments.

*Eyes* consisting of 25 contiguous ocelli, arranged in 5 rows of 7, 6, 5, 4, 3 each, inner row of seven, the outer of three.

*Antennae* long and slender, third segment the longest; fourth, fifth, and sixth not very unequal in length, the fifth a little longer than either.

First *tergal plate* semicircular (fig. I. 1, p. 521); of the three setiferous tubercles on each side, the middle one is a little nearer to the inner than to the outer, which is above the lateral angle. From the first tergite backwards to the middle of the body the lateral or outer tubercle gradually increases in size to form a large tuberculiform excrescence on each side; the other tubercles are smaller and close above it, the median larger than the inner (fig. I. 1 a). Thus the three tubercles are completely lateral. In the posterior half of the body the external tubercle gradually dwindles in size and loses its prominence, the last segments, excluding the anal, being furnished with six tubercles, subequal in size and subequally spaced, arranged in a transverse row across the terga from side to side (fig. I. 1 b).

*Bristles* stout and aciculate. Segments crescentically grooved laterally.

♂. *Legs* of first, second, and third pairs unmodified; of fourth, fifth, sixth, and seventh thickened, "fleshy," with terminal segment long, arcuate, with the concavity postaxial, extremity of the fourth pair (fig. I. 1 c) ending in a small button-shaped prominence like the tip of a foil; those of the fifth and sixth pairs apically rounded, clawless; that of the seventh pair with its distal half expanded, compressed, and postaxially excavated, ending in a short stout claw (fig. I. 1 d). Coxal segments of seventh appendage (fig. I. 1 e, 1 f, 7) enlarged, produced posteriorly into an acuminate and elongate bristly process. Legs of *eighth* pair (fig. I. 1 e, 1 g, 8)

dwarfed, hyaline, terminating distally in a pair of backwardly directed processes, an outer acuminate, an inner expanded and laminate. Legs of *ninth* pair (fig. I. 1 *e*, 1 *g*, 9) terminating in an oval subglobular segment (? femur), the preceding segment (? trochanter) with a conical bristly process. On the inner side of this segment proximally may be seen two processes, one longer and curving inwards and then forwards, the other shorter, acuminate, directed vertically downwards. Legs of *tenth* pair (fig. I. 1 *e*, 1 *h*) small, consisting of five segments, widely separated from each other and rising from the external angles of a broad transverse plate, to the anterior surface of which is attached a second plate furnished inferiorly with three processes—a median (stout, angular, compressed) and one on each side (slender, arcuate, and curved forwards in its distal half). The apertures of the seminal coxal pouches (*teste* Verhoeff) appearing as a pair of slits between the plate that bears the appendages and that which bears the processes.

The type and only known species of this genus is the form from Dunedin, New Zealand, described by F. W. Hutton as *Craspedosoma trisetosum* (Ann. & Mag. Nat. Hist. (4) xx. p. 116, 1877).

The characters given above are taken (1) from a female specimen, no doubt Hutton's type, which came from the Otago University Museum, and was received by the British Museum from the Commissioners of the New Zealand Section of the Colonial Exhibition of 1886; (2) from a single damaged male example, probably belonging to the same species as the female, which was captured at Maungatua by Mr. J. V. Jennings.

The male has considerably larger lateral keels than the female, but otherwise the two differ but little apart from genuine sexual features. The head is olive-brown in colour, with the vertex yellow. The antennæ are infusate, flavous at the base. The segments are flavo-olivaceous with a median fuscous band, and fuscous laterally round the base of the tubercles, which are paler. Integument coarsely coriaceous and squamulate. Length 13 millim.

Other characters which will no doubt prove to be of specific value are contained in the generic diagnosis.

*Huttoniella* differs from related forms, so far as general characters as exemplified in the females are concerned, in the features tabulated in the subjoined synopsis (p. 522).

In such characters it differs considerably from *Hetero-*

*chordeuma* as attested by *H. monticola*, Poc. (Max Weber's Zool. Ergeb., Chilopoda &c. p. 342, pl. xix. fig. 14 g, 1894).

The description given of the gonopods of this last-named species must be emended as follows:—The legs of the eighth pair are reduced to a pair of small, unjointed, apically recurved apophyses, proximally contiguous, distally divaricated at an acute angle, and underlying the coxæ of the ninth pair. Legs of ninth pair with long, stout, subcylindrical coxal apophysis, from the base of which rises a slender, curved, apically spatulate, backwardly directed flagellum; the second segment (? trochanter) is relatively small; the third segment (? femur) enlarged, oval and inflated as in *Huttoniella*, but to a lesser degree. The tenth leg is like the ninth in form, although smaller, but the coxal apophysis has no flagellum and the third segment is much smaller, shorter, and only a little inflated. In the original description the ninth and tenth legs were erroneously described as the modified appendages of the seventh segment—that is to say, as the eighth and ninth. Thus the male of *Heterochordeuma* differs greatly from that of *Huttoniella* in the form of the gonopods, as it also does in the nature of the modification affecting the anterior legs.

#### Genus HENDERSONULA, nov.

Related to *Huttoniella*, but differing in the following particulars:—On the first tergal plate (fig. I. 2) the intermediate tubercles are nearer to the external than to the internal. On the median segments the internal tubercle is the largest of the three. The keels are distinct plate-like processes and not formed by the enlarged external tubercle (fig. I. 2 a). On the posterior segments the three tubercles on each side retain their lateral position, the two internals being widely separated from each other in the middle line (fig. I. 2 b).

Male unknown.

Type *Hendersonula collina*, sp. n.

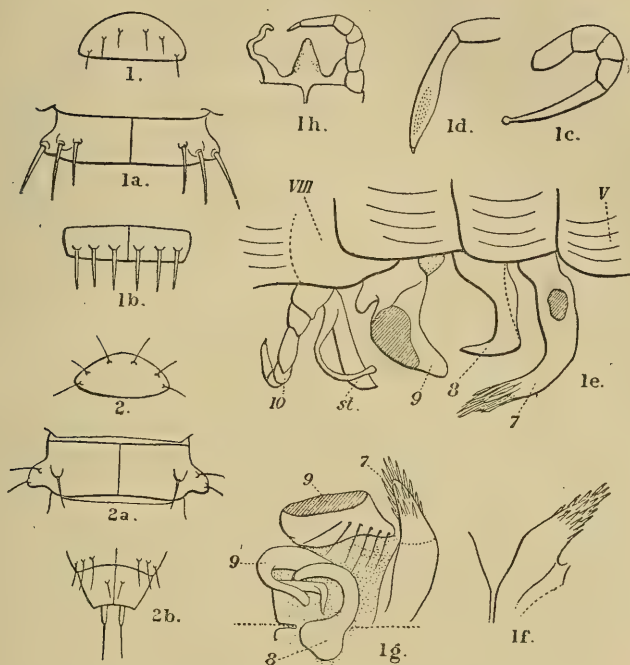
I have great pleasure in dedicating this genus to Dr. J. R. Henderson, of the Christian College, Madras, who sent a valuable collection of Myriopods from South India to the British Museum some years ago. Amongst these was the type of the species described below—the first species of Chordeumoidea to be discovered in India proper.

#### *Hendersonula collina*, sp. n.

♀.—*Colour* nearly black or very deep brown above, infero-lateral area of segments pale; antennæ blackish, with the



Fig. I.



1. *Huttoniella trisetosa* (Hutton), ♂. First tergal plate.
- 1 a. Ditto. Tergal plate of mid-region of body.
- 1 b. Ditto. Tergal plate towards posterior end.
- 1 c. Ditto. Terminal segments of fourth leg.
- 1 d. Ditto. Distal segment of seventh leg from behind.
- 1 e. Ditto. Lateral view of gonopods: v. and VIII., lateral portion of fifth and eighth segments of body; 7, coxa of seventh leg, the rest of the segments removed; 8, eighth leg; 9, ninth leg, with ovally inflated segment removed; 10, tenth leg, with median and lateral sternal processes (*st.*).
- 1 f. Ditto. Right coxal apophysis of seventh leg from below.
- 1 g. Ditto. Basal portion of seventh, eighth, and ninth legs seen from below and slightly obliquely from the inner side; 7, coxal apophysis of seventh leg; 8, distal extremity of eighth appendage; 9, proximal (? second) segment of ninth appendage with ovally inflated segment removed; 9', coxal or sternal processes of ninth appendage; median ventral line represented by dots.
- 1 h. Ditto. Left leg and sternal apparatus of tenth pair, seen from behind.
2. *Hendersonula collina*, gen. et sp. n., ♀. First tergal plate.
- 2 a. Ditto. Tergal plate of mid-region of body.
- 2 b. Ditto. Last two tergal plates.

basal segment pale; head deep brown, labral region flavous; legs flavous, distally infuscate.

*Antennæ* incrassate, third segment twice as long as the fourth, which is about equal to the sixth in length and to two thirds of the fifth.

*Eyes* consisting of 15 circular separated ocelli, arranged in three vertical series of 3, 6, 6, the short row the innermost of the three.

*Terga* coriaceous, with fine polygonal ornamentation; lateral area of keel-bearing portion furnished with arched striæ, with the concavity upwards. Keels with anterior border convex, posterior concave; anterior angle widely rounded, posterior acute.

Length 6.5 millim., width barely 1 millim.

*Loc.* South India: Kodeikanal, in the Palnai Hills (*J. R. Henderson*).

The females of the four described genera of *Heterochordeumidæ*, of which *Pocockia* is unknown to me, may be distinguished as follows:—

- a. Segments without keels or lateral tuberculiform prominences ..... *Pocockia*.
- b. Segments with keels or large lateral tuberculiform prominences.
  - a<sup>1</sup>. Segments with very wide depressed keels equalling the median area in width and carrying the external setiferous tubercle on their lateral borders; this tubercle remote from the others which remain upon the median tergal area ..... *Heterochordeuma*.
  - b<sup>1</sup>. Segments with small, sometimes tuberculiform keels, at least in the mid-region of the body; these keels less than half the width of the median tergal area; tubercles on the middle segments laterally aggregated, the external not remote from the rest.
    - a<sup>2</sup>. On the median segments the internal tubercle the largest; on the posterior segments the tubercles are lateral in position, the internal tubercles being widely separated in the middle line. .... *Hendersoniella*.
    - b<sup>2</sup>. On the median segments the external tubercle the largest; on the posterior segments the internal tubercles not lateral but narrowly separated mesially ..... *Huttoniella*.

#### IULOIDEA.

##### Genus MONGOLIULUS, nov.

♂. Appendages of first pair (fig. II. 1, *app.* 1., and 1 *a*, p. 524) consisting of five segments only, the first three short,

the fourth very long and stout, the fifth (representing the fifth and sixth in *Paraiulus*) shorter and thinner. Appendages of second pair (fig. II. 1, *app.* II. and *p.*) dwarfed, but normal in form, armed with a long claw, and consisting of five free segments, of which the basal is the trochanter, the elongate coxæ being fused together and with the sternum to constitute a vertical columnar sclerite which bears the penis on its posterior side. Anterior appendages of the sixth segment (=sixth appendage) normal, the posterior appendage (=seventh leg) reduced to an inconspicuous three-jointed conical bud rising from the side of the enlarged sternum and concealed by the infero-lateral edge of the sixth tergal plate; sternal area of the appendage, perhaps containing the coxal element of the latter, produced into a pair of long, antero-posteriorly compressed, immovable, blade-like sclerites, fringed externally and internally with long hairs (fig. II. 1 *b*). Appendages of the seventh segment (eighth and ninth pairs of legs) formed upon the same plan as those of the majority of the North-American species of *Paraiulus* (fig. II. 1 *c*, 1 *d*). Segments 1-7 open below, the sterna not coalesced with the terga.

♀. Legs of the first and second pairs subequal in size, normal in form; no large sclerites developed in connexion with the generative orifices. Segments 1-4 open below, third leg not attached to the fourth segment; inferior angles of first segment projecting inwards like those of the second.

Type *M. coreanus*, Poc.

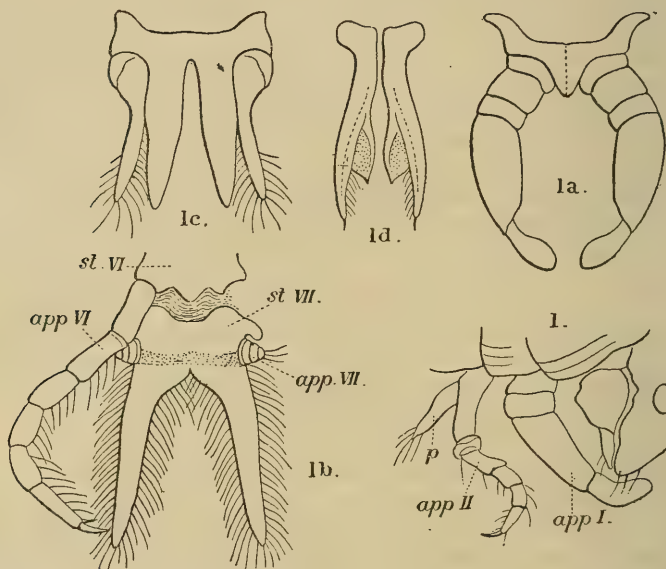
The type species of this genus was assigned to the genus *Paraiulus* (Ann. & Mag. Nat. Hist. (6) xv. p. 365, pl. xi. fig. 12, 1895). It is represented in the British Museum by an adult female and two adult males. Certain specific features not mentioned in the original description are shown in the annexed figures (p. 524).

This very remarkable genus presents a complex of characters distinguishing it from all its nearest allies. The female is nearer that of *Iulus* than of *Paraiulus*, as is testified by the size of the second leg and the absence of genital plates. Its gnathochilarium is like that of *Paraiulus*. It differs from both in the freedom of the sternum of the third leg, which in both *Iulus* and *Paraiulus* is attached to the fourth tergal plate. The inward projection of the inferior angles of the first tergal plate is also characteristic.

The male in the structure of the gnathochilarium and first leg recalls *Paraiulus*, though the suppression of one of the segments of the last-mentioned limb shows departure

from the type found in that genus. In the structure of the second appendage a stage of specialization intermediate between those of *Iulus* and *Paraiulus* is seen; but in the extraordinary modification of the limbs of the seventh pair and their adjacent sternal area, which results in the complete annexation of these structures by the copulatory apparatus, *Mongoliulus* stands alone, so far as I know, in the Chilognatha. As opposed to this specialized feature is the primitive characteristic presented by the freedom of the sternal

Fig. II.



1. *Mongoliulus coreanus*, Poc., ♂. Portion of anterior extremity from the side, showing appendages of first and second pairs (*app. I.* and *II.*) and penis (*p.*) *in situ*.
- 1 a. Ditto. Appendages and sternum of first pair.
- 1 b. Ditto. Appendages and sterna of sixth and seventh pairs, the left appendage of the sixth pair removed. *st. VI.* and *app. VI.*, sternum and appendage of sixth pair; *app. VII.*, dwarfed appendage of seventh pair; *st. VII.*, sternum of seventh appendages, with hairy blade-like processes.
- 1 c. Ditto. Appendages of eighth pair (coleopods).
- 1 d. Ditto. Appendages of ninth pair (phallopods).

elements of the anterior nine pairs of appendages. To sum up: the male of *Mongoliulus* is an advance upon the male of *Paraiulus* in the structure of the first leg and the almost total suppression of the seventh pair correlated with the modification of the adjacent sternal plate, and stands at a



lower grade of evolution in the freedom from the terga of the sterna bearing the third to seventh appendages and the simpler more archaic construction of the second appendage. The female, on the other hand, except in the form of the first tergite, is less specialized than the female of *Paraiulus*, the freedom of the sternum of the third leg, the absence of genital plates, and the large size of the second legs, all being archaic characteristics. In both sexes, as in *Paraiulus* and *Iulus*, the legs of the first and second pairs belong, I believe, to the first and second segments respectively—or, at all events, whatever view with regard to the matter be correct, no difference is to be found in the three genera mentioned. This opinion differs from those put forward by Brölemann (Ann. Soc. Ent. Fr. 1902, pp. 440–446) and Humbert and de Saussure in 1872, which I believe to be incorrect. Brölemann's criticisms of the view of the Swiss zoologists may be accepted as final. He himself gives the leg-formula for segments 1 to 6 as follows—0, 1, 1, 1, 2, 2—basing it upon the alleged discovery of a limbless sternal plate for the first tergite behind the hypostoma of the gnathochilarium and in front of the sternal plate bearing the legs of the first pair. This sternal plate is of large size and was described and figured by Humbert and Saussure. By Silvestri it was taken to be the hypostoma; but Brölemann found a transverse plate between it and the plate he regards as the mentum, and this he holds to be the hypostoma. On this point, I think, Silvestri was right. The large plate appears to be the hypostoma and to be the sternal element of the posterior region of the head, to the sides of which it is attached. The hypostoma of Brölemann may be a special development arising from the chitinization of the membrane between the hypostoma and the mentum; or it is possible that the four plates of the gnathochilarium in the genus which Brölemann names (1) first sternum, (2) hypostoma, (3) mentum, and (4) promentum, may be the homologues of the four plates in *Cambala* which Silvestri designates (1) basilar, (2) infrabasilar, and (3, 4) the anterior and posterior inframaxillaries (Ann. Mus. Genova, xxxvi. p. 51, fig. 14, 1896). In this connexion the three transverse plates lying behind the stipites in *Paraiulus* may be suggestively compared with the three figured by Cook in his drawing of the gnathochilarium of the male of *Stemmiulus bellus* (Amer. Nat. 1895, pl. xli. fig. 1).

In support of his view Brölemann further alleges the dwarfed appendages of the second pair in the female, at least in one of the species examined by him, namely *P. ellipticus*, to be adherent to the vulval sclerites, lodged in the third

segment, and therefore themselves to belong to the third segment. But in the females of three Central-American species dissected by myself these appendages arise from a small sternal plate separated by a very distinct membranous area from the genital plates. Finally, in the immature or *Pseudoiulus* stage of *Paraiulus aztecus* the arrangement of the appendages is the same as in *Iulus*—that is to say, the first appendages lie between the gnathochilarium and the inward prolongations of the second segment, the second appendages behind the latter and the corresponding area of the third segment, and the third appendages are attached to the sternal plate which is fused to the tergum of the fourth segment. Thus *Iulus* and *Paraiulus* are in agreement in these respects.

Although resembling *Paraiulus* in many striking particulars, *Mongoliulus* differs from that genus in both sexes in certain structural characters which have, in my opinion, a greater taxonomic value than those which serve to distinguish the three so-called families, Iulidæ, Blaniulidæ, and Nemasomidæ (Isobatidæ). If these three groups and the Pæromopidæ retain the rank assigned to them by Cook and Silvestri, consistency will compel the adoption of a section of the same rank, the Mongoliulidæ, for *Mongoliulus*. Even if they be reunited under the one heading Iulidæ, a strong case could still be made out for the recognition of the Mongoliulidæ, especially since further researches into the structure of the various species now included under the names *Paraiulus* and *Ptyoiulus* will no doubt bring to light materials for the splitting of these genera into several additional genera, equivalent to those into which the old genus *Iulus* has been broken up by Berlese and Verhoeff.

The differential characters of the Mongoliulidæ, Paraiulidæ, and Pæromopidæ, as compared with the better-known Iulidæ and related European families, may be tabulated as follows:—

*a.* Mandibles with about ten rows of pectinations.

*a*<sup>1</sup>. Male with first leg enormously developed, forming a five- or six-jointed clasper; second legs dwarfed (? sometimes suppressed) and attached to a sterno-coxal plate showing scarcely a trace of sutures; gnathochilarium with promentum oval, armed with a downwardly directed tooth-like process, the lingual lobes crescentically curved on each side of it; each of the coleopods, consisting of two independently movable processes, subequal in length.

*a*<sup>2</sup>. Male with legs of first pair six-jointed, of second pair, when present, small,

palpiform, four-jointed, the sterno-coxal plate enormous, wide, deeply excavated behind for the reception of the penis; sterna of fourth, fifth, and sixth segments fused to the terga; appendages and sterna of sixth segment normal. Female with sternum and appendages of second segment greatly reduced; genital orifices protected by large chitinous plates, sternum of third segment united to the tergum.....

**Paraiulidæ.**

- b<sup>2</sup>. Male with legs of first pair five-jointed, of second pair small but not palpiform, armed with a long claw, consisting of five segments, in contact at the base and rising from the distal extremity of a long cylindrical column, representing the sterno-coxal elements, and not excavated behind for the lodgment of the penis; sterna of fourth, fifth, and sixth segments not fused to terga; anterior appendages of sixth segment normally pediform, the posterior reduced to a conical three-jointed bud concealed by the tergum and attached to the enlarged sternal plate, which is produced inferiorly into a pair of long blade-like excrescences. Female with sternum and appendages of second segment normal, as in *Iulus*; no special sclerites developed in connexion with the genital apertures, sternum of third segment free from tergum .....

**Mongoliulidæ.**

- b<sup>1</sup>. Male with first leg short, greatly modified to form a broad, thickly chitinized, at most two-jointed sclerite, the basal segment very short, the distal much longer and, at least sometimes, hooked apically; second legs normal in length, longer than the first, their coxæ separated by a very distinct median suture; gnathochilarium unmodified; promentum triangular, lingual lobes converging distally on each side of it; coleopods consisting of a single sclerite composed of two pieces united by a suture but not independently movable, the anterior (inner) piece much shorter than the posterior (outer). Female with second leg normal in size and structure, its coxæ thickened and strongly chitinized, no distinct genital plates like those of *Paraiulus*.

**Pæromopidæ\*.**

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\* Apart from its mandibles *Pæromopus*, of which I have seen one male and one female belonging to different species, is much more nearly related to the Iulidæ than to the Paraiulidæ and Mongoliulidæ.

## b. Mandible with about four rows of pectinations.

First leg in male not enlarged, slightly or considerably modified; gnathochilarium unmodified. Second leg in female normal; no large genital sclerites .....

Iulidæ, Blaniulidæ,  
Nemasomidæ.

## SPIROBOLOIDEA.

## Genus EUCENTROBOLUS, nov.

*Labral pores* 2 + 2.

*Antennæ* about as long as the uncovered portion of the head, relatively close together, the distance between them about equal to the distance between the edge of the labrum and the summit of the antennal socket, and the distance between the antennal socket and the nearest point on the lateral border of the head equal to half the distance between the two sockets and to three times the diameter of the basal antennal segment. Subocular area of head hollowed longitudinally, so that the inferior edge of the ocular area stands up as a distinct and obtuse ridge. Distance between eyes scarcely equal to  $1\frac{1}{2}$  times their transverse diameter.

First *tergal plate* large, with a row of tubercles along its posterior border, which is slightly elevated. Postsulcal area of all the remaining terga except the last elevated and furnished with a transverse row of blunt tubercular spines from twelve to fifteen in number, irregularly spaced, the intervals between them occupied by smaller tubercles.

*Sterna* transversely ridged.

*Pores* beginning upon the sixth segment, small, in advance of the sulcus, those of the sixth segment on the same level as the rest.

*Anal tergite* produced into a long caudal process.

*Eucentrobolus tamulus*, sp. n.

♂.—*Colour* black, not shining; legs and antennæ ferruginous.

*Head* granularly rugose, transversely grooved inferiorly, the median groove deep above and below, mesially obsolete; forehead lightly depressed.

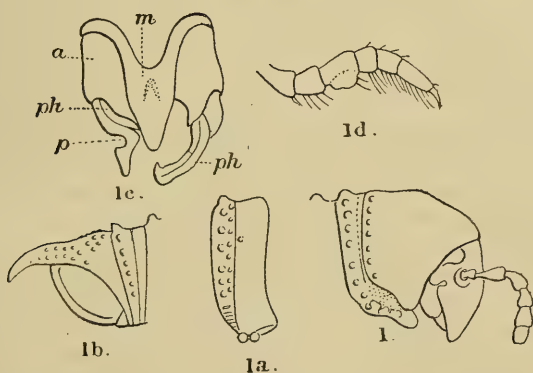
*Eyes* consisting of about thirty-five ocelli.

First *segment* very large, the widest of the body, coarsely coriaceous, the anterior border lightly concave inferiorly, inferior angle acute but rounded, posterior border somewhat abruptly and obliquely cut away to form the posterior border of the inferior angular termination. Second segment with



its infero-lateral portion tubercular and extending below that of the first, thickened and produced externally and inferiorly, its posterior angle obtusely rounded, its anterior angle acute and underlying the corresponding angle of the first; in addition to the low and irregular tubercles upon the inferior crest the segment is furnished with fifteen large tubercles as well as some smaller ones. Third and fourth segments narrower than the second or fifth, the latter slightly wider than the second. The anterior and median areas of the segments not differentiated, forming a continuous area covered with a reticulation of very fine ridges, which on the anterior part of the inferior portion of the segments run into definite transverse ridges in front and obliquely transverse ridges behind. The posterior elevated portion of the segments coarsely ridged inferiorly below the tubercles; the elevated portion furnished with an anterior row of smaller tubercles in addition to the larger and smaller ones forming the posterior row (fig. III. 1 a).

Fig. III.



1. *Eucentrobolus tamulus*, gen. et sp. n., ♂. Head and first two segments.  
 1 a. Ditto. Segment of mid-region of body.  
 1 b. Ditto. Last two segments.  
 1 c. Ditto. Gonopods from anterior side. *m*, median, *a*, anterior, and *p*, posterior sclerites of coleopod; *ph*, phallopods withdrawn and protruded.  
 1 d. Ditto. Left leg of third pair.

*Anal segment*: tergite closely granular, its median dorsal area longitudinally and bluntly carinate and tubercular; caudal process long, attenuate, projecting horizontally, then sharply curled down at the apex, tubercular. Valves

granular, with strongly compressed margins. Sternite granular, its posterior border convexly rounded (fig. III. 1 *b*).

*Legs* with several stiff setæ on the lower sides of segments 3 to 6 in the anterior portion of the body; the setæ becoming less numerous at the posterior end; basal segment with two setæ, second mostly with one distal seta. Third segment of third and fourth legs in male thickened below (fig. III. 1 *d*).

♀.—Very like the male, except for the presence of a single seta upon the lower side of the segments of the legs. Terga of first and second segments similarly formed.

Number of segments 51.

*Measurements in millimetres*.—♂. Total length 160; width of first segment 12.5, of sixth (excl. tubercles) 11, of median 11, of penultimate segment 8.

*Loc.* South India: Tinnevely (type ♂) (*C. A. Barber*); Trivandrum, in Travancore (*H. Ferguson*).

*Eucentrobolus tamulus* belongs to the same category of species as the form from Madras which I described as *Spirobolus uroceros* (*Journ. Bombay Nat. Hist. Soc.* vii. p. 269, pl. ii. fig. 7, 1892). The two, however, differ so greatly in the sculpturing of the terga that in the absence of intermediate types they may be regarded as generically distinct. For *Spirobolus uroceros* I propose the name *Aulacobolus*. The differential characters of the two genera are given in the table below.

In the sculpturing of the terga these two genera recall *Acanthiulus*, Gervais, but differ from it essentially in the presence of the large and strong caudal process.

*Acanthiulus* was proposed by Gervais (*Ann. Sci. Nat.* (3) i. p. 70, and *Ins. Apt.* iv. p. 173, 1847) for the species from New Guinea described by Le Guillou as *Iulus Blainvillei* (*Bull. Soc. Phil. Paris*, 1841, p. 86). In 1893 (*Ann. & Mag. Nat. Hist.* (6) xi. p. 136) I described a second species of the genus, *A. Murrayi*, from the Aru Islands, and in the following year a third species was established by Daday (*Term. Füzetek*, xvi. p. 101), under the name *Spirobolus dentatus*, from New Guinea, without any notification on the part of the author of similarity between his species and Le Guillou's. The two species come from the same island, and it is impossible to doubt that they are closely related, even if they be not identical. It is to be observed that *Acanthiulus dentatus* differs from the form I described as *Acanthiulus Murrayi* in the position of the pores upon the posterior elevated area of the terga—that is to say, behind the sulcus. In *A. Murrayi* they are distinctly in advance of it, as in *Trigoniulus*. Nothing is said about the position of these organs in the

description of *Blainvillei*, the type of *Acanthiulus*; but the similarity in other particulars between *dentatus* and *Blainvillei* justifies the conclusion that in the latter form also they occupy the abnormal backward position described and figured by Daday in his species. In that case *Murrayi* cannot, strictly speaking, fall into the genus *Acanthiulus*, but must stand apart as the type of another genus, for which the name *Polybunobolus* is proposed. *P. Murrayi* further differs from *dentatus* and *Blainvillei* in the much greater length of the antennæ. This, however, may be a character only of specific value.

The four Oriental genera under discussion may be distinguished as follows:—

- a. Anal segment armed with a long, stout, apically pointed caudal process.
  - a<sup>1</sup>. Posterior area of terga not longitudinally grooved, but furnished with a row of larger and smaller tubercles irregular in size and spacing ..... EUCENTROBOLUS, nov.
  - b<sup>1</sup>. Posterior area of terga longitudinally grooved and furnished with a series of low tubercles equal in size and evenly spaced, situated upon the areas between the grooves ..... AULACOBOLUS, nov.
- b. Anal segment not produced into a caudal process surpassing the valves.
  - a<sup>2</sup>. Pores in front of the sulcus on the median area of the terga; antennæ even in the female much longer than face ..... POLYBUNOBOLUS, nov.
  - b<sup>2</sup>. Pores behind the sulcus on the posterior elevated area of the terga; antennæ short, even in male not longer than face. ACANTHIULUS, Gerv.

# COLOBOGNATHA.

## ? Genus SIPHONOTUS, Brandt.

### *Siphonotus brevicornis*, sp. n.

♀.—*Colour* yellow, with two conspicuous fuscous patches on each segment, forming a pair of fuscous bands extending from the first to the last tergal plate, the patches larger and closer together on the anterior than on the posterior terga; hence the median yellow band that separates them is wider posteriorly than anteriorly.

*Head* piriform, longitudinally grooved above, hairy below.

*Antennæ* very short and thick, not longer than head, all the segments much wider than long.

*Terga* finely rugose, with faint longitudinal striæ; pleuræ coriaceous.

Number of segments 64.

Length 23 millim., width about 1 millim.

Loc. Narre Warren, in S. Gippsland, Victoria (*Prof. Baldwin Spencer*).

One female specimen. A more detailed examination upon fresh material may prove this species to be generically distinct from *Siphonotus*. No examination of the gnathochilarium was made.

LII.—*Diagnoses of Four new Species of Barbus from the Nile.* By G. A. BOULENGER, F.R.S.

A STUDY of the very numerous small specimens of the genus *Barbus*, mostly young of the larger species, collected by Mr. Loat in the Nile, has revealed the existence of four undescribed species, of which diagnoses are here given in anticipation of the descriptions and figures which will appear in the forthcoming work on the Fishes of the Nile.

*Barbus neglectus.*

D. III 8. A. III 5. Sq. 26–30  $\frac{3\frac{1}{2}-4\frac{1}{2}}{3\frac{1}{2}}$ .

Depth of body 3 to  $3\frac{2}{3}$  times in total length, length of head 4 to  $4\frac{1}{3}$  times. Diameter of eye  $2\frac{1}{2}$  to 3 times in length of head; two barbels on each side, anterior about  $\frac{1}{2}$  diameter of eye, posterior as long as eye or a little shorter. Origin of dorsal nearer end of snout than root of caudal; last simple ray not ossified. Ventrals below or a little behind origin of dorsal. Caudal peduncle 1 to  $1\frac{1}{3}$  as long as deep. 2 or  $2\frac{1}{2}$  scales between lateral line and ventral fin, 12 round caudal peduncle. Yellowish, with a broad silvery lateral band.

Total length 54 millim.

Nile Delta and Luxor.

*Barbus miolepis.*

D. III 7–8. A. III 5. Sq. 24–25  $\frac{4\frac{1}{2}}{3\frac{1}{2}-4\frac{1}{2}}$ .

Depth of body 3 to  $3\frac{1}{2}$  times in total length, length of head  $3\frac{1}{2}$  to 4 times. Diameter of eye  $2\frac{1}{2}$  to  $3\frac{1}{3}$  times in length of head; barbels two on each side, anterior a little shorter than eye, posterior as long as eye or a little longer. Origin



of dorsal equally distant from end of snout and from root of caudal; last simple ray not ossified. Ventrals below origin of dorsal. Caudal peduncle  $1\frac{1}{3}$  to  $1\frac{1}{2}$  as long as deep. 2 scales between lateral line and ventral, 12 round caudal peduncle. Three or four black dots or round spots on the side of the body, the second below the dorsal.

Total length 36 millim.

White Nile.

*Barbus anema.*

D. III 8. A. III 5. Sq. 22-25  $\frac{3\frac{1}{2}}{3\frac{1}{2}}$ .

Depth of body  $2\frac{2}{3}$  to  $3\frac{1}{3}$  times in total length, length of head  $3\frac{1}{3}$  to 4 times. Diameter of eye  $2\frac{3}{4}$  to 3 times in length of head; no barbels. Origin of dorsal equally distant from end of snout and from root of caudal; last simple ray not ossified. Ventrals a little behind origin of dorsal. Caudal peduncle not or but slightly longer than deep. 2 or  $2\frac{1}{2}$  scales between lateral line and ventral, 8 or 10 round caudal peduncle. Scales above the lateral line usually black-edged; often a black lateral streak.

Total length 37 millim.

Nile between Assuan and Luxor, and White Nile.

*Barbus stigmatopygus.*

D. III 8. A. III 5. Sq. 22-25  $\frac{3\frac{1}{2}-4\frac{1}{2}}{2\frac{3}{4}-3\frac{1}{2}}$ .

Depth of body equal or nearly equal to length of head, 3 to  $3\frac{1}{2}$  times in total length. Diameter of eye 3 times in length of head; no barbels. Origin of dorsal equally distant from end of snout and from root of caudal; last simple ray not ossified. Ventrals below origin of dorsal. Caudal peduncle  $1\frac{1}{2}$  to  $1\frac{2}{3}$  as long as deep.  $1\frac{1}{2}$  scales between lateral line series and ventral, 9 or 11 round caudal peduncle. Lateral line reduced to 3 to 6 tubules on the anterior scales. A small round black spot at the base of the caudal and another at the base of the anal; one or two further spots often present on the middle of the side.

Total length 24 millim.

White Nile.

LIII.—*On the Classification of the Thalassinidea.* By L. A. BORRADAILE, M.A., Lecturer in Natural Sciences at Selwyn College, Cambridge.

WITH the one exception of the Penæidea, there is now no tribe of Decapod Crustaceans whose systematy is so uncertain as that of the Thalassinidea. This is in part owing to the lack of any monograph or revision of the group; but there can, unfortunately, be no doubt that it is also partly due to the Report on the 'Challenger' Macrura, which in many places parts company both with the facts and with the statements of other writers (as Boas, Claus, Ortmann, and Alcock), and is not to be relied upon, either in the text or in the figures, for information as to gill-formulæ, antennal spines, or even the shape of the legs, on all which points it has misled and puzzled later writers. In the following attempt to lay the groundwork of a better knowledge of this group—a detailed revision of which would need more material than I had before me—the facts have been gotten by an examination of the specimens in the British and Cambridge Museums and from the works of sundry writers, chiefly those mentioned above\*. For allowing me to examine the collections under his charge, and for his hospitality at the British Museum while I was doing so, my best thanks are due to Prof. F. Jeffrey Bell. I am also under great obligation to Dr. W. T. Calman for kindly examining several specimens for me.

I have not attempted a full list of references of the species or a detailed account of their distribution †, and in many

- \* BOAS, J. V. "Studien over Dekapoderms Slægtskabsforhold," Kong. Danske Vidensk. Selskab. Skrifter, vi. i. (1880).  
 CLAUS, C. 'Neue Beiträge zur Morphologie der Crustaceen,' Wien, 1885 (Arb. Zool. Inst. Wien, vi.).  
 ORTMANN, A. E. "Die Decapoden-Krebse des Strassburger Museums," iii. Theil, Zool. Jahrb. vi. Syst. i. (1891).  
 ——. Art. "Crustacea" in Bronn's 'Thierreich,' v. ii. (1901).  
 ALCOCK, A. 'Descriptive Catalogue of the Indian Deep-sea Crustacea Decapoda Macrura . . .' Calcutta, 1901.

† The letters which are placed after the names of species in the lists given in this paper show very roughly their distribution, as follows:—

- A. North Atlantic, to the Mediterranean and Cape Hatteras.
- B. Mediterranean.
- C. West Africa.
- D. South Atlantic, including South Africa.
- E. East America, from Cape Hatteras to the River Plate.
- F. Southern Australia, with Tasmania and New Zealand.

cases the information available has not been enough to enable me to place them satisfactorily. It follows, of course, that the diagnoses of the genera can only be approximately correct, and are liable to be altered in detail by the inclusion of other species. No doubt the discovery of new species will have the same result. The chief character on which our knowledge of the recorded forms is defective is the gill-formulæ, and, while the systematic value of these has been somewhat overrated, there can be no doubt that it is considerable and that they afford useful guidance in the more primitive family Axiidæ. In the Callianassidæ, on the other hand, and particularly in the Upogebiinæ, they will, I think, be found to give less help, since they are here more constant.

The Thalassinidea are a group of tailed Decapods which recall the hermit-crabs in some respects and the lobsters and crawfish in others. They are like the Nephropsidea in the shape of the tail-fin and of the first and often also the second leg. They differ from them in never having the third leg chelate, often in a reduction of the number of their gills, and in a tendency of their abdomen to become soft and lose its pleura. This is to be connected with their mode of life, which is in most cases a burrowing one. Herein they show the same habit of concealment as the Paguridea, to which they are also akin in the other points of difference from the Nephropsidea already mentioned, in the thorn-like shape of the antennal scale in such of them as have it well developed, in the freedom of the last thoracic sternite, and in their peculiar way of carrying the last pair of legs rather apart from and above the rest. They differ from the hermit-crabs in the fact that these legs are nevertheless shaped much like the rest, that their second pair of legs are usually chelate, and that their abdomen is symmetrical with a broad tail-fin. A remarkable feature, which recalls the prawns, is the presence in most of them of an *appendix interna* on the abdominal limbs. They may be divided into four families—Axiidæ, Laomediidæ, Thalassinidæ, and Callianassidæ. The characters and subdivisions of these are set forth below, and will be found summed up in key form on p. 549.

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G. West America, below California.

H. North Pacific to California and Vladivostock.

I. Indo-Pacific.

Of these divisions, A, B, and H together make up Ortmann's Arctic region, while D and F are his Antarctic region. The deep- and shallow-water forms are arranged by the same set of regions.

## Family Axiidæ, Bate, 1888.

Definition: "Thalassinidea with a *rostrum* of good size; without the groove or crack which runs lengthwise on each side of the cephalothoracic carapace in the other families of the group, and is known as the *linea thalassinica*; with the antennular flagella of a good length, the antennal scale present\* as a movable thorn-like structure between the second and third joints of the antennal stalk, and an immovable thorn outside the scale on the second joint; the first pair of legs chelate, large, unequal, the second pair ending in small equal chelæ, the third to fifth pairs simple, the fifth sometimes tending to be subchelate; no gill on the first maxilliped, mastigobranchs on legs 1-4, podobranchs on legs 1-3 †, pleurobranchs present or not; the gills trichobranch, with narrow filaments; the *pleura* of the abdominal segments well or moderately well developed; the abdominal limbs 1-5 with *appendix interna*, their branches narrow or fairly broad, and the last pair of limbs with the endopodite unjointed and the exopodite jointed or not."

Genera: *Axius*, *Axiopsis*, *Calocaris*, *Scytoleptus*.

## Genus AXIUS, Leach, 1815.

Definition: "Axiidæ in which the body is more or less compressed from side to side in front of the cervical groove, so that the back in this region shows a platform, which may be either flat or convex, and is often marked at its edges and along the middle line by ridges, though these do not, as in *Scytoleptus*, end short of the *rostrum* in strong teeth, but are continued on to it, and that at about the same level and without a steep fall; with or without pleurobranchs, and with no suture on the exopodite of the last limb."

The genus *Axius*, as thus defined, contains all the Axiidæ whose last limb has no suture, with the exception of *Scytoleptus*. Various groups of its species have from time to time been regarded as worthy of independent rank, and these, with another group of the same value, are kept as subgenera in the present scheme. This course has been taken because, on the one hand, there are undoubtedly considerable differences between any two of them, and, on the other hand, they are so connected with one another that it is as yet impossible to devise any satisfactory way of separating them into full genera. A number of characters seem to be of real morphological importance, as showing a primitive condition, and

\* Perhaps not in *Scytoleptus*.

† *Axius acanthus* has a podobranch on the fourth leg.



have been used in the definitions below ; but the evidence of each of these as to the relationships of the subgenera contradicts that of the rest, and there are none of those special features which are so useful in separating groups of species in other cases. Sooner or later, however, a considerable rearrangement is likely to be necessary.

Subgenera: *Axius*, *Neaxius*, *Iconaxiopsis*, *Eiconaxius*, *Paraxius*.

Subgenus *AXIUS*, Leach, 1815.

Definition: "Species of *Axius* with the flat area of the back and the cervical groove well marked, the eyes well pigmented, the antennal thorns both of a good size, pleurobranches on the second to fifth legs, vestiges of a podobranch and an arthrobranch on the second maxilliped, and a shallow-water habitat."

Species:

Type. *A. stirhynchus*, Leach, 1815. Tr. Linn. Soc. xi. A.

Subgenus *NEAXIUS*, n.

Definition: "Species of *Axius* with the flat area of the back and the cervical groove well marked, the eyes well pigmented, the antennal thorns both of a good size, no pleurobranches, vestiges of gills sometimes present on the second maxillipeds \*, and a shallow-water habitat."

Species:

Type. *A. acanthus*, A. M.-Edw., 1879. Bull. Soc. Philom. [= *A. taliliensis* (Borradaile), 1900]. I.

*A. plectorhynchus*, Strahl, 1862. Mon.-Ber. Ak. Berlin, 1861. I.

? *A. glyptocercus*, Martens, 1869. " " " 1868. I.

? *A. Gundlachi* (Martens), 1872. Arch. Naturges. xxxviii. i. E.

Subgenus *ICONAXIOPSIS*, Alc., 1901.

Definition: "Species of *Axius* with the flat area of the back and the cervical groove indistinct, the eyes almost or quite without pigment, the antennal thorns both of a good size, pleurobranches on the second to fourth legs, vestigial gills on the second maxilliped, and a deep-water habitat."

Species:

Type. *A. laccudivensis*, Alc., 1894. J. As. Soc. Bengal, lxiii. I.

*A. andamanensis* (Alc.), 1901. Ind. Deep-sea Macrura and Anomala. I.

? *A. farræ* (Ortm.), 1891. Zool. Jahrb. vi. Syst. i. I.

Subgenus *EICONAXIUS*, Bate, 1888.

Definition: "Species of *Axius* with the flat area of the

\* *A. plectorhynchus*, specimens in Brit. Mus. ; not *A. acanthus*.

back and the cervical groove more or less indistinct, the eyes pale, the antennal thorns both of a good size, pleurobranchs on the second to fourth legs, no vestiges of gills on the second maxillipeds \*, and a deep-water habitat."

Species :

- Type. *A. acutifrons* (Bate), 1888. 'Challenger' Macrura. I.  
*A. kermadeci* (Bate), 1888. 'Challenger' Macrura. I.  
*A. parvus* (Bate), 1888. " " I.  
 ? *A. crista-galli*, Fax., 1893. Bull. Mus. Harvard, xxiv. G.

Subgenus PARAXIUS, Bate, 1888.

Definition: "Species of *Axius* with the flat area of the back and the cervical groove not sharply marked, the eyes pale, the antennal thorns both very small, no pleurobranchs, no gills on the second maxilliped, and a deep-water habitat."

Species :

- Type. *A. altus* (Bate), 1888. 'Challenger' Macrura. I.

Lack of information makes it impossible to place the following species:—

- A. serratus*, Stimps., 1852. Proc. Boston Soc. Nat. Hist. iv. A.  
*A. armatus*, S. I. Smith, 1880. P. U.S. Nat. Mus. iii. A.  
*A. spinulicauda*, Rathb., 1902. P. U.S. Nat. Mus. xxiv. H.  
*A. elegans*.

Genus AXIOPSIS, n.

Definition: "Axiidæ with a flat area on the back in the fore part of the carapace well marked and continuous with the *rostrum*, no keel on the carapace behind the cervical groove, the eyes well pigmented, the antennal thorns long or of middle size, the legs of the second pair chelate, [an arthrobranch and a podobranch on the second maxilliped, no pleurobranchs †], and a suture on the exopodite of the last limb."

Species :

- Type. *A. affinis* (de Man), 1887. Arch. Naturges. liii. i. I.  
*A. princeps* (Boas), 1880. Dansk. Vidensk. Selsk. Skrifter, (6) i. H.  
*A. spinipes* (de Man), 1887. Arch. Naturges. liii. i. I.  
 ? *A. biserratus* (Martens), 1869. Mon.-Ber. Ak. Berlin, 1868. I.  
 ? *A. serratifrons* (A. M.-Edw.), 1873. J. Mus. Godef. iv. I.

\* As it was very difficult to be certain of this point in the small specimens of *Eiconaxius* and *Paraxius*, from which the jaws of one side had sometimes been removed, it is possible that the above statement may be wrong. In that case the last difference between *Eiconaxius* and *Iconaxiopsis* will have gone, for the exopodite of the second maxilla of the former is longer than the endopodite, and not as Bate figures it.

† These particulars as to the gills refer to the type only. They may or may not be true of the other species, which I have not examined.

- ? *A. nodulosus* (Meinert), 1877. Naturh. Tidsskr. (3) xi. A.  
 ? *A. Brocki* (de Man), 1887. Arch. Naturges. liii. i. I.  
 ? *A. Picteti* (Zehntner), 1894. Rev. Suisse Zool. ii. I.  
 ? *A. defensus* (Rathb.), 1900. Bull. U.S. Fish Comm. E.  
 ? *A. inæqualis* (Rathb.), 1900. " " E.

The species described by de Man in 1887 (Arch. Naturges. liii. i.) as *Axius chypeatus* should probably become the type of a new genus, with the following characters:—

"Back arched in the fore part of the carapace, no keel behind the cervical groove, eyes well pigmented and with long stalks, and a small oval end-joint on the exopodite of the last limb." The gills are unknown.

#### Genus CALOCARIS, Bell, 1853.

Definition: "Axiidæ with the body subcylindrical and the back arched, the cervical groove distinct, a toothed ridge extending backwards from each edge of the *rostrum* towards the cervical groove, which it does not meet, a third ridge running the whole length of the carapace in the middle line, the eyes almost or quite without pigment, an arthrobranch on the second maxilliped\*, no pleurobranchs, and a suture on the exopodite of the first limb." All the known species live in deep water.

Subgenera: *Calastacus*, *Calocaris*.

#### Subgenus CALASTACUS, Fax., 1893.

Definition: "Species of *Calocaris* in which the antennal thorns are of a good size."

Species:

- Type. *C. stilirostris* (Fax.), 1893. Bull. Mus. Harvard, xxiv. G.  
*C. investigatoris* (And.), 1890. J. As. Soc. Bengal, lxxv. I.  
*C. felix* (Alc. & And.), 1899. Ann. & Mag. Nat. Hist. (7) iii. I.  
*C. longispinis* (McArdle), 1901. " (7) viii. I.  
*C. quinqueseriatus* (Rathb.), 1902. P. U.S. Nat. Mus. xxiv. H.

#### Subgenus CALOCARIS, Bell, 1853.

Definition: "Species of *Calocaris* in which the antennal thorns are minute."

Species:

- Type. *C. Macandreae*, Bell, 1853. Brit. Stalk-eyed Crust. A, B, I.  
*C. Alcocki*, McArdle, 1900. Ann. & Mag. Nat. Hist. (7) vi. I.

#### Genus SCYTOLEPTUS, Gerst., 1856.

[= *Evaxius*, Kingsley, 1882.]

Definition: "Axiidæ whose back is arched in the fore part

\* Absent in *C. stilirostris* (?).

of the carapace, but marked off by a ridge on each side, bears a third ridge in the middle, each of the ridges ending short of the fore edge of the carapace in a strong tooth, and falls steeply to the *rostrum*; with pigmented eyes, without any vestige of scale or fixed thorn on the antenna (?), and with no suture on the exopodite of the last limb." The gills are not known.

Species :

Type. *S. serripes*, Gerst., 1850. Arch. Naturges. xxii. I.  
*S. tricarinatus* (Kingsley), 1882. Bull. Essex Inst. xiv. I.

Family **Laomediidæ**, n.

Definition: "Thalassinidea with the *rostrum* of a good size; *linea thalassinica* present; antennular flagella rather short, no vestige of antennal scale (?) or fixed thorn; the first pair of legs large, chelate, equal, the second pair simple or subchelate, the third and fourth simple, the fifth subchelate; mastigobranchs on all the thoracic limbs except the last, podobranchs at least on the third to sixth, arthrobranchs on the second to seventh; the gills trichobranch, with somewhat broadened filaments; the *pleura* of the abdominal segments fairly well developed; the abdominal limbs without *appendix interna*, and the last pair of limbs with a suture on both exopodite and endopodite."

Many points with regard to the two genera of this family are still unsettled. The gill-formula of *Laomedia* is as yet uncertain as regards the maxillipeds. The lack of an *appendix interna* on the abdominal limbs of *Jaxea* is only to be inferred indirectly from the fact that Heller does not mention it in his careful description, and from its absence in the allied *Laomedia*. Heller does not say that the endopodite of the last limb in *Jaxea* (his *Calliaxis*) has a suture, but he figures one clearly. Lastly, it may well be that here (and in *Scytoleptus* also) careful search would show that a trace of the antennal scale remains.

Genera: *Laomedia*, *Jaxea*.

Genus **LAOMEDIA**, de Haan, 1849.

Definition: "Laomediidæ which have on the maxillipeds of the first pair no lash to the exopodite nor podobranch, the chelæ in the legs of the first pair stout, and those of the second pair simple."

Species :

Type. *L. astacina*, de Haan, 1849. Von Siebold's 'Fauna Japonica,' Crust. I.



## Genus JAXEA, Nardo, 1847.

[= *Calliaxis*, Heller, 1856.]

Definition: "Laomediidæ which have on the maxillipeds of the first pair a lash to the exopodite and a podobranch, the chelæ in the legs of the first pair slender, and those of the second pair subchelate."

## Species :

Type. *J. nocturna*, Nardo, 1847. *Sinonimia moderna* \* [= *C. adriatica*, Heller, 1856]. B.

## Family Thalassinidæ, Dana, 1852.

Definition: "Thalassinidea with a *rostrum* of fair size; a *linea thalassinica*; antennular flagella of moderate length, no vestige of antennal scale † or fixed thorn; the first and second pairs of legs subchelate ‡, the rest simple; mastigobranchs on legs 1-4, podobranchs on legs 1-3, no pleurobranchs, the gills partly trichobranch, partly with broad plates; the *pleura* of the abdominal segments small; the third to fifth abdominal limbs without *appendix interna*, the branches of the abdominal limbs narrow, and the last pair without suture on endopodite or exopodite."

Genus: *Thalassina*, Latr., 1806.

## Species § :

Type. *T. anomala* (Hbst.), 1801. Naturges. Krabben u. Krebse, iii. ii. [= *T. scorpionoides*, Latr., 1806, = *T. maxima*, Hess, 1865, ? = *T. gracilis*, Dana, 1852.] I.

*T. chilensis*, Steenstrup & Lütken, 1861. Nat. Foren. Vidensk. Meddelelser. G.

## Family Callianassidæ, Bate, 1888.

Definition: "Thalassinidea whose *rostrum* may be either of a good size or small; which have the *linea thalassinica*, the antennular flagella short or of moderate length, the antennal scale quite vestigial, and no antennal thorn; the legs of the first pair usually chelate or subchelate, but sometimes simple, those of the second pair chelate or simple, those of the third and fourth pairs simple, and those of the fifth pair simple, subchelate or chelate; the legs without podobranchs and

\* See also Ann. Ist. Venet. xiv.

† There are some small irregular knobs between the second and third joints of the antennal stalk, but Boas shows that neither of these represents the scale.

‡ Bate's figure is quite wrong in regard to the second leg.

§ According to Ortmann (Bronn's 'Thierreich,' v.) there is probably only one species.

usually without mastigobranchs, no pleurobranchs; the gills trichobranch or with filaments broadened in various degrees; the *pleura* of the abdominal segments almost wanting; the third to fifth abdominal limbs with or without *appendix interna*, their branches broad, and the last pair of limbs without suture on endopodite or exopodite."

Subfamilies: Upogebiinae, Callianassinæ.

#### Subfamily UPOGEBIINÆ, n.

Definition: "Callianassidæ with the *rostrum* of a good size; the legs of the first pair chelate, subchelate, or simple, but equal and not with a very broad wrist and palm, those of the second pair equal, simple (except in *Bigea*), those of the third pair with the propodite of normal width; no mastigobranchs (except sometimes vestiges on the maxillipeds of the first two pairs); and the second pair of abdominal limbs with broad branches like the third to fifth, which have no *appendix interna*."

Genera: *Upogebia*, *Gebicula*, *Bigea*.

#### Genus UPOGEBIA, Leach, 1814.

[= *Gebia*, Leach, 1815, = *Gebios*, Risso, 1826, ? = *Calliadne*, Strahl, 1862.]

Definition: "Upogebiinae with the legs of the first pair chelate or subchelate, those of the second pair simple, those of the fifth pair usually not chelate, and the two branches of the last limb broad and stout and not longer than the telson."

Subgenera: *Gebiopsis*, *Upogebia*.

#### Subgenus GEBIOPSIS, A. M.-Edw., 1868.

Definition: "Species of *Upogebia* in which the 'thumb' is almost or quite as long as the movable finger, and there is no small tooth on the fore edge of the carapace over the antenna."

Species:

Type. *U. nitida* (A. M.-Edw.), 1868. Nouv. Arch. Mus. iv. C.

*U. deltaura* (Leach), 1815. Tr. Linn. Soc. xi. A.

*U. Darwini* (Miers), 1884. 'Alert' Report. [= *U. intermedia* (de Man), 1887.] I.

*U. Bowerbanki* (Miers), 1884. 'Alert' Report. F.

*U. isodactyla* (Ortm.), 1891. Zool. Jahrb. vi. Syst. i. I.

*U. hexacerus* (Ortm.), 1894. Jena Denkschr. viii. v. I.

? *U. Savignyi* (Strahl), 1862. Mon.-Ber. Ak. Berlin, 1861. B.

#### Subgenus UPOGEBIA, Leach, 1814.

Definition: "Species of *Upogebia* in which the 'thumb'

is distinctly shorter than the movable finger, and there is a small sharp tooth on the fore edge of the carapace over the antenna."

Species :

- Type. *U. stellata* (Mont.), 1808. Tr. Linn. Soc. ix. A, B.  
*U. littoralis* (Risso), 1816. Crust. de Nice. [= *U. lacustris*, Costa, 1844, = *U. venitarum*, Nardo, 1847.] A, B.  
*U. affinis* (Say), 1817. Journ. Ac. Philadelphia, i. E.  
*U. capensis*\* (Krauss), 1843. Südafrik. Crust. S.  
*U. hirtifrons* (White), 1847. P. Z. S. ? F.  
*U. major* (de Haan), 1849. Fauna Japonica, Crust. I.  
*U. pugettensis* (Dana), 1852. U.S. Expl. Exped., Crust. ii. [= *U. californica*, Stimps., 1854.] H.  
*U. carinicauda* (Stimps.), 1860. Proc. Ac. Philadelphia. I.  
*U. subspinosa* (Stimps.), 1860. I.  
*U. barbata* (Strahl), 1862. Mon.-Ber. Ak. Berlin, 1861. I.  
*U. longipollex* (Streets), 1871. Proc. Ac. Philadelphia. G.  
*U. spinigera* (S. I. Smith), 1871. Rep. Peabody Ac. 1869. G.  
*U. Danai* (Miers), 1876. Ann. & Mag. Nat. Hist. (4) xvii. [= *U. hirtifrons*, Dana, 1852.] F.  
*U. rugosa* (Lockington), 1878. Ann. & Mag. Nat. Hist. (5) ii. F.  
*U. Simsoni* (Thompson), 1893. Proc. Roy. Soc. Tasmania, 1892. F.  
*U. africana* (Ortm.), 1894. Jena Denkschr. viii. v. I.  
*U. furcata* (Aurivillius), 1898. Bih. Svenska Ak. xxiv. iv. i. C.  
? *U. spinifrons* (Haswell), 1882. Proc. Linn. Soc. N.S.W. vi. F.

Genus *GEBICULA*, Alc., 1901.

Definition: "Upogebiinae with the legs of the first pair simple, those of the second pair also simple, those of the fifth pair chelate, and the two branches of the last limb foliaceous, larger than the telson."

The distinctness of this genus from *Upogebia* is doubtful. According to Haswell's figure (Cat. Austral. Crust.) the first leg of *U. spinifrons* would appear to be simple; but in his definition of the genus he makes no exception to the rule that the limb is subchelate, and in his definition of the species he does not allude to the point. The last leg is chelate in *Gebiopsis Darwini*, and in several other species is subchelate. The telson of *U. Simsoni* seems to be shorter than the last limb, but the figure given by Thompson is rather hard to understand, the limbs being drawn outwards from the telson. Alcock's description and his figure, which is from the side, are also not clear on this point, but, so far as they can be followed, the last limb in *Gebicula* seems to be of a more primitive shape than that of *Upogebia*.

Species :

- Type. *G. exigua*, Alc., 1901. Ind. Deep-sea Macrura and Anomala. I.

\* The remarkable fact, mentioned by Stebbing (South Afric. Crust. i.), that this species has gills on the last pair of legs, will probably make it needful to separate it as a subgenus with such others as may share the character.

## Genus BIGEA, Nardo, 1869.

Definition: "Upogebiinae with the legs of the second pair chelate and all the rest simple."

It is somewhat remarkable that this genus is only known by an old drawing, but there seems to be no reason to doubt its existence.

Species:

Type. *B. tipica* (sic), Nardo, 1869. Ann. Ist. Venet. xiv. B.

## Subfamily CALLIANASSINÆ, n.

Definition: "Callianassidæ with the *rostrum* small or almost wanting; the legs of the first pair chelate, unequal, the larger one usually with a very broad wrist and palm, those of the second pair equal, chelate, those of the third pair with a broad propodite; mastigobranchs present or not on the hinder thoracic limbs, but always a large one on the first maxilliped; and the second pair of abdominal limbs like or unlike the third to fifth, which have an *appendix interna*."

Genera: *Callianassa*, *Glypturus*, *Callianidea*.

## Genus CALLIANASSA, Leach, 1814.

Definition: "Callianassinæ with the eyes flattened against one another (except in *Scallasis*), the ischiopodite and meropodite in the maxillipeds of the third pair broader than the carpopodite and propodite; the third pair of legs usually bearing a lobe on the hinder edge of the propodite, which thus takes on a characteristic shape; those of the fifth pair more or less distinctly subchelate; no mastigobranchs on the legs or third maxilliped, but a large one (epipodite) on the first and usually a small one on the second, no gill-like filaments on the third to fifth pairs of abdominal limbs, and the plates of the tail-fin not deeply graven."

The species of this genus are so many that it would be well if they could be grouped in subgenera. Unfortunately this is far from easy, partly because so little is known about most of them. In the following arrangement the characters made use of are the shape of the maxillipeds of the third pair and that of the tail-fin, on which great weight was laid by A. Milne-Edwards in his revision (Nouv. Arch. Mus. vi.), and the propodite of the legs of the third pair, which is needed for some species that have become known since he wrote. The most primitive members of the genus are those with a long narrow telson, narrow third pair of maxillipeds, and oval propodites on the legs of the third pair, such as



*C. securo*, *C. amboinensis*, and *C. cœcigena*. From these there stand off, on the one hand, the little group of *C. lignicola* and *C. rotundicaudata*, with shorter telson and a broader third pair of maxillipeds, and, on the other hand, the species, such as *C. subterranea*, which have narrow third maxillipeds and a long telson, but also a lobe on the hinder edge of the propodite in the third pair of legs, whereby this limb takes on the shape which is typical of the genus. Hence, again, two lines branch out: one leads to such forms as *C. gigas*, which have still long telsons, but very broad third maxillipeds; the other, containing such forms as *C. brevicaudata*, has a short telson, but often keeps the third maxillipeds fairly narrow. Between the two groups of which these species are typical there is, however, an almost complete series, and they cannot be sharply separated.

Subgenera: *Calliactites*, *Cheramus*, *Trypæa*, *Callichirus*, *Scullasis*.

Subgenus CALLIACTITES, n.

Definition: "Species of *Callianassa* with the maxillipeds of the third pair narrow or more or less broadened, no lobe on the hinder edge of the propodite in the legs of the third pair, the endopodite of the last limb of medium width or rather narrow, and the telson usually long, never very short." Three out of the six species are from deep water.

Species:

- Type. *C. securo*, Lanchester, 1902. P. Z. S. 1901. I.  
*C. amboinensis*, de Man, 1887. Arch. Naturges. liii. i. I.  
*C. cœcigena*, Alc. & And., 1894. J. As. Soc. Bengal, lxiii. I. (deep water).  
*C. lignicola*, Alc. & And., 1899. Ann. & Mag. Nat. Hist. (7) iii. I. (deep water).  
*C. rotundicaudata*, Stebbing, 1902. South African Crust. ii. S.  
 ? *C. goniophthalma*, Rathb., 1900. Proc. U.S. Nat. Mus. xxiv. H. (deep water).

Subgenus CHERAMUS\*, Bate, 1888.

Definition: "Species of *Callianassa* with the maxillipeds of the third pair narrow, a lobe on the hinder edge of the propodite on the legs of the third pair, the endopodite of the last limb of medium width or broad, and the telson long."

Species:

- Type. *C. subterranea* (Mont.), 1808†. Tr. Linn. Soc. ix. A.  
*C. pachyductyla*, A. M.-Edw., 1870. Nouv. Arch. Mus. vi. C.

\* This name cannot be used for any genus which contains *C. subterranea*, as it must then be replaced by *Callianassa* on the ground of priority. As a subgeneric name it holds good.

† The true *C. subterranea* is a species which keeps both the primitive

- C. orientalis* (Bate), 1888. 'Challenger' Macrura. I.  
*C. minima*, Rathb., 1900. Bull. U.S. Fish Comm. E.  
*C. Batei*, nom. n. [= *C. occidentalis*, Bate, 1888, nom. præoc.\*] E.  
 (deep water).  
 ? *C. subterranea*, var. *minor*, Gourret, 1887. C. R. Ac. Fr. cv. B.

Subgenus *TRYPÆA* †, Dana, 1852.

Definition: "Species of *Callianassa* with the maxillipeds of the third pair very broad, a lobe on the hinder edge of the propodite on the legs of the third pair, the endopodite of the last limb broad and square-ended, and the telson as long as, usually longer than, it is broad, almost or quite as long as the endopodites of the last pair of limbs."

Species:

- Type. *C. australiensis* (Dana), 1852. U.S. Expl. Exped., Crust. ii. F.  
*C. uncinata*, H. M.-Edw., 1837. H. Nat. Crust. ii. G.  
*C. gigas*, Dana, 1852. U.S. Expl. Exped., Crust. ii. H.  
*C. californiensis*, Dana, 1854. Proc. Ac. Philadelphia, vii. [= *C. occidentalis*, Stimps., 1856.] H.  
*C. longimana*, Stimps., 1856. Proc. Boston Soc. Nat. Hist. vi. H.  
*C. porcellana* (Kinahan), 1858. Journ. Roy. Dublin Soc. i. F.  
*C. chilensis*, A. M.-Edw., 1860. Ann. Sci. Nat. (4) xiv. G.  
*C. brachyophthalma*, A. M.-Edw., 1870. Nouv. Arch. Mus. vi. I.  
*C. mauritiana*, Miers, 1882. P. Z. S. I.  
*C. truncata*, Giard & Bonnier, 1890. Bull. Sci. Fr. Belg. xxii. A.  
*C. japonica*, Ortm., 1891. Zool. Jahrb. vi. Syst. I.  
*C. Harmandi*, Bouvier, 1901. Bull. Mus. Paris. I.  
*C. maldivensis*, n. sp. See 'Fauna of the Maldives,' ed. Gardiner, II. iii. I.  
 ? *C. petalura*, Stimps., 1860. Proc. Ac. Philadelphia, 1860. I.

Subgenus *CALLICHIKIRUS* ‡, Stimps., 1866.

Definition: "Species of *Callianassa* with the maxillipeds of the third pair usually narrow as compared with those of *Trypæa*, a lobe on the hinder edge of the propodite in the

characters of this subgenus, but seems, by the hook on its arm, to be near the ancestor which gave rise to *Trypæa*, where this is a common feature.

\* Doubly preoccupied, first by Stimpson in 1856 as a synonym for *C. californica*, Dana, and later by Bate himself in 1888.

† According to the recognized rules of zoological nomenclature (for instance, by Art. V. 5, of the Code of Rules adopted by the last Zoological Congress), this name must be given to the subgenus before us, although the most striking feature of Dana's *Trypæa*—the extreme shortness of the antennular flagella—is not characteristic of it as now constituted. *C. australiensis* must remain the type species, although *C. uncinata* or *C. gigas* would have been more suitable.

‡ *Callichirus* becomes the name and *C. major* the type of this subgenus by the same rule that makes *Trypæa* the name and *C. australiensis* the type of the foregoing one. *C. brevicaudata* would probably be a better type.

legs of the third pair, the endopodite of the last limb narrow and pointed or rounded at the end, and the telson as broad as or broader than it is long, distinctly shorter than the endopodites of the last pair of limbs."

Species :

- Type. *C. major*, Say, 1817. Journ. Ac. Philadelphia, i. E.  
*C. laticauda*, Otto, 1828. Nov. Act. Leop. Carol. xiv. A, B.  
*C. mucronata*, Strahl, 1862. Mon.-Ber. Ak. Berlin, 1861. I.  
*C. Turnerana*, White, 1861. P. Z. S. C.  
*C. tridentata*, Martens, 1869. Mon.-Ber. Ak. Berlin, 1868. I.  
*C. armata*, A. M.-Edw., 1870. Nouv. Arch. Mus. vi. I.  
*C. brevicaudata*, A. M.-Edw., 1870. " " I.  
*C. longiventris*, A. M.-Edw., 1870. " " I.  
*C. Bocourti*, A. M.-Edw., 1870. " " I.  
*C. madagassa*, Long & Richters, 1882. Abh. senck. Ges. I.  
*C. Martensi*, Miers, 1884. P. Z. S. I.  
*C. novæ-guinææ*, Thallwitz, 1890. Abh. Mus. Dresden. I.  
*C. diademata*, Ortm., 1891. Zool. Jahrb. vi. Syst. C.  
*C. Grandidieri*, Coutière, 1899. Bull. Mus. Paris. I.  
*C. novæ-britanniæ*, Borradaile, 1900. Willey's Zool. Results, iv. I.  
*C. marginata*, Rathbun, 1900. Bull. U.S. Fish Comm. E.  
*C. Kraussi*, Stebbing, 1900. South African Crust. i. S.  
*C. affinis*, Holmes, 1900. Pap. Calif. Acad. vii. H.  
*C. Stebbingi*\*, nom. nov. [= *C. subterranea*, auct.] A, B.

Subgenus SCALLASIS, Bate, 1888.

Definition: "Species of *Callianassa* with the eyes rounded, bearing the cornea at the end, the maxillipeds of the third pair fairly broad, the endopodites of the last pair of limbs narrow, rounded at the end, and the telson about as broad as long, almost as long as the last pair of limbs."

Species:

Type. *C. amboinæ* (Bate), 1888. I.

The shape of the eyes is not, I think, a primitive feature in this species, but it must, for the present at least, remain in a separate subgenus. The third to fifth abdominal limbs are narrower than is common in *Callianassa*, and somewhat recall *Callianidea*. Bate's statements respecting the gills in this subgenus and in *Cheramus* are unreliable. The specimens are now much damaged, but each had probably nine pairs of gills (arthrobranchs). The third pair of maxillipeds are broader in *Scallasis* than this author implies.

\* Named after Mr. Stebbing, who has shown [Hist. Crust. p. 184 (1893)] that Leach's species is distinct from the form usually called *C. subterranea*. Details of the latter and of *C. laticauda* are given by Giard and Bonnier (Bull. Sci. Fr. Belg. xxii. p. 362), and it is probably the species figured by H. Milne-Edwards in the great illustrated edition of Cuvier's 'Règne Animal.'

Not having seen specimens or descriptions of the following species, I am unable to place them :—

*C. Krukenbergi*, Neumann, 1878. Syst. Uebersicht Gatt. *Oxyrhynch.*, &c., Leipzig, 1878.

*C. Filholi*, A. M.-Edw., 1878. Bull. Soc. Philom.

*C. Stimpsoni*, Smith, 1874.

*C. celebica*, de Haan.

The following, being known only by the chela, also cannot be placed :—

*C. occidentalis*, Bate, 1888. 'Challenger' Macrura. E. (Nom. præoc.)

#### Genus GLYPTURUS, Stimps., 1866.

Definition : "Callianassinæ with the eyes flattened against one another, the ischiopodite and meropodite in the maxillipeds of the third pair not broader than the carpopodite and propodite ; no gill-like filaments on the abdominal limbs, the second pair of which have narrow branches ; the endopodites of the last pair of limbs broad and triangular, the telson very small, and the plates of the tail-fin deeply graven."

##### Species :

Type. *G. acanthochirus*, Stimps., 1866. Proc. Ac. Sci. Chicago, i. E.

*G. grandimana* (Gibbes), 1850. Proc. Am. Assoc. iii. E.

*G. Branneri*, Rathb., 1900. Bull. U.S. Fish Comm. E.

#### Genus CALLIANIDEA, H. M.-Edw., 1837.

[= *Isea*, Guérin, 1832, = *Callianisea*, H. M.-Edw., 1837, = *Callisea*, Dana, 1852.]

Definition : "Callianassinæ without *linea thalassinica*, with the eyes flattened against one another, bearing the cornea on the outside ; the ischiopodite and meropodite in the maxillipeds of the third pair not broader than the carpopodite and propodite, the propodite in the legs of the third pair without a lobe on the hinder edge ; mastigobranchs on all the thoracic limbs except the last ; gill-like filaments on the second to fifth abdominal limbs, which are all alike, with moderately broad oval branches, the branches of the last pair of limbs rather narrow and oval, not deeply graven, and the telson long:"

##### Species :

Type. *C. typa*, H. M.-Edw., 1837. H. Nat. Crust. ii. I.

? = *C. elongata* (Guérin), 1832. Ann. Soc. Entom. France, (1) i. I.

*C. levicauda*, Gill, 1859. Proc. Ac. Philadelphia, xi. E.

*C. Steenstrupi*, Boas, 1880. Danske Vidensk. Selsk. Skrifter, (6) i. E.

*C. mucronata*, Kossm., 1880. Reise Roth. Meer. ii. I.

The number of genera in the four families is 13,—4 in the Axiidæ, 2 in the Laomediidæ, 1 in the Thalassinidæ, and 6 in the Callianassidæ. If subgenera be counted in, the total



will rise to 23. The number of species is about 125, these, like the genera, being more numerous in the more specialized family Callianassidæ than in the others. The greater number of the species in all the families are Indo-Pacific. The species are generally restricted to one region, but the genera are well distributed, showing no tendency to restriction to particular regions in any case except that of the little genus *Glypturus* from the West-Indian region. Most of the known species live in shallow water, but, with the exception of the widespread *Calocaris Macandreae*, the deep-sea forms (below 200 fath.) can conveniently be arranged by means of the same set of regions; and this has been done above. The deep-water species are chiefly concentrated in *Eiconaxius*, *Iconaxiopsis*, *Paraxius*, and *Calocaris*, which have no shallow-water forms, but there are a few scattered among the other genera, and these have been noted in the lists. *Thalassina anomala* makes its burrows on land, but they probably always go down to water.

#### Key to the Families of the Thalassinidea.

- I. No *linea thalassinica*. Both movable and fixed antennal thorns present, though sometimes minute (♀ absent in *Scytoleptus*). Abdominal *pleura* large ..... **Axiidæ.**
- II. *Linea thalassinica* present (except in *Callianidea*). Fixed antennal thorn wanting, scale reduced to a flattened vestige or wanting. Abdominal *pleura* usually small.
  - 1. Sutures on both exopodite and endopodite of last limb. Abdominal *pleura* of a good size.. **Laomedidiæ.**
  - 2. No sutures on the last limb. Abdominal *pleura* small.
    - a. Second leg chelate or simple. No podobranchs on legs. Abdominal limbs 3-6 broad. A vestige of antennal scale remains. **Callianassidæ.**
    - b. Second leg subchelate. Podobranchs on legs 1-3. Abdominal limbs all narrow. No vestige of antennal scale ..... **Thalassinidæ.**

#### Key to the Genera of the Axiidæ.

- I. A suture on the exopodite of the last limb. [Antennal thorns present, large or small.]
  - 1. Eyes pigmented. Back flat. No keel in the hinder part of the carapace at least. .... *Axiopsis*.
  - 2. Eyes pale. Back arched. A keel runs the whole length of the carapace in the middle line ..... *Calocaris*.
- II. No suture on the exopodite of the last limb.
  - 1. Back not falling steeply to *rostrum*. Antennal thorns present, large or small ..... *Axius*.
  - 2. Back falling steeply to *rostrum*. Antennal thorns lost (♀) ..... *Scytoleptus*.

*Key to the Subgenera of Axius.*

- I. Eyes pigmented. Flat area of back and cervical groove well marked. [Antennal thorns large.]
  - 1. Pleurobranches on legs 2-4 ..... *Axius.*
  - 2. No pleurobranches ..... *Neaxius.*
- II. Eyes pale. Flat area of back and cervical groove more or less indistinct.
  - 1. Pleurobranches on legs 2-4. Antennal thorns large.
    - a. Gills on second maxilliped ..... *Iconaxiopsis.*
    - b. No gills on second maxilliped ..... *Eiconaxius.*
  - 2. No pleurobranches. Antennal thorns small .... *Paraxius.*

*Key to the Subgenera of Calocaris.*

- I. Antennal thorns large ..... *Calastacus.*
- II. Antennal thorns small ..... *Calocaris.*

*Key to the Genera of the Laomediidæ.*

- I. No lash to exopodite of first maxilliped. First leg with stout chela. Second leg simple ..... *Laomedea.*
- II. A lash to exopodite of first maxilliped. First leg with slender chela. Second leg subchelate .... *Javea.*

*Key to the Subfamilies of the Callianassidæ.*

- I. *Rostrum* large. Legs of first pair equal. No *appendix interna* on abdominal limbs 3-5 ..... UPOGEBIINÆ.
- II. *Rostrum* small. Legs of first pair unequal. An *appendix interna* on abdominal limbs 3-5 ..... CALLIANASSINÆ.

*Key to the Genera of the Upogebiinæ.*

- I. Legs of second pair simple.
  - 1. Legs of first pair chelate or subchelate. Last limb not longer than telson ..... *Upogebia.*
  - 2. Legs of first pair simple. Last limb longer than telson ..... *Gebicula.*
- II. Legs of second pair chelate ..... *Bigea.*

*Key to the Subgenera of Upogebia.*

- I. Legs of first pair chelate. No tooth on the fore edge of the carapace over the antenna ..... *Gebiopsis.*
- II. Legs of first pair with "thumb" distinctly shorter than movable finger. A tooth on the fore edge of the carapace over the antenna ..... *Upogebia.*

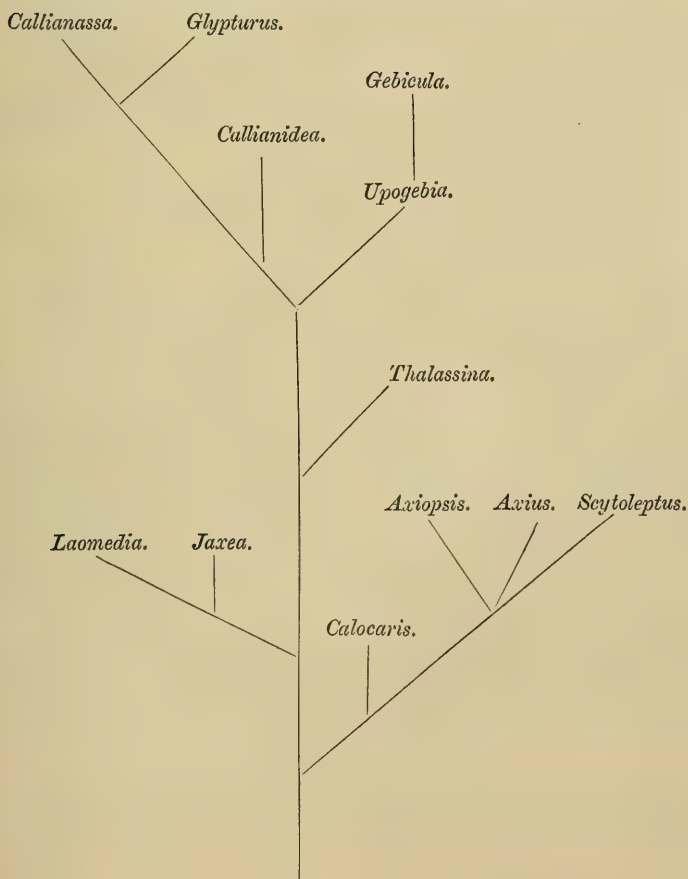
*Key to the Genera of the Callianassinæ.*

- I. No gill-like filaments on abdominal limbs. Second abdominal limb unlike third to fifth. No mastigobranchs on legs.
  - a. Plates of tail-fin not deeply sculptured. Ischiopodite and meropodite of third maxilliped broader than carpopodite and propodite. .... *Callianassa.*
  - b. Plates of tail-fin deeply sculptured. Ischiopodite and meropodite of third maxilliped not broader than carpopodite and propodite ..... *Glypturus.*
- II. Gill-like filaments on abdominal limbs 2-5, which are all alike. Mastigobranchs on legs 1-4 .... *Callianidea.*

*Key to the Subgenera of Callianassa.*

- I. Eyes flattened against one another, with the cornea usually on the outside.
1. Propodite of the third leg without a lobe on the hinder edge..... *Calliactites.*
  2. Propodite of the third leg with a lobe on the hinder edge.
    - a. Telson long.
      - a. Third maxillipeds narrow ..... *Cheramus.*
      - b. Third maxillipeds very broad..... *Trypæa.*
    - b. Telson short and broad ..... *Callichirus.*
- II. Eyes rounded, bearing the cornea at the end .... *Scallasis.*

The genealogical relations between the genera of Thalassinidea are probably those shown in the following tree:—



LIV.—*Descriptions of new Batrachians in the British Museum.* By G. A. BOULENGER, F.R.S.*Bufo fissipes.*

Crown without bony ridges; snout short, prominent, obliquely truncate; interorbital space as broad as the upper eyelid; tympanum quite hidden, eustachian tubes indistinct. Fingers rather slender, first and second equal; toes rather slender, with a mere rudiment of web; subarticular tubercles single; two moderate oval metatarsal tubercles; no tarsal fold. The tarso-metatarsal articulation reaches beyond the tip of the snout. Upper parts with scattered, very prominent, smooth tubercles; parotoid glands moderately prominent, rather narrow, a little shorter than the head, diverging behind. Dark brown above, with yellowish spots; upper surface of snout and anterior half of forehead and upper eyelid yellowish; limbs with oblique yellowish cross-bars; sides black; belly yellowish, marbled with blackish.

From snout to vent 40 millim.

A single female specimen from Santo Domingo, Carabaya, S.E. Peru, 6000 feet, collected by Mr. G. Ockenden.

*Eupemphix Gadovii.*

Snout obliquely truncate, strongly projecting beyond the mouth; canthus rostralis obtuse; loreal region nearly vertical; interorbital space broader than the upper eyelid; tympanum hidden. Fingers rather short, obtuse, first shorter than second; toes short, obtuse, free; subarticular tubercles moderate; inner metatarsal tubercle rather large, oval, prominent, outer round and flat; no tarsal tubercle. The tarso-metatarsal articulation reaches the shoulder. Skin smooth. Blackish brown above, with a silvery-white vertebral line and a broad, wavy, whitish band on each side from the end of the snout to the groin; lower parts white, dotted or marbled with whitish.

From snout to vent 11 millim.

Three specimens of this minute form were obtained at San Mateo del Mar, near Tehuantepec, by Dr. and Mrs. Gadow during a recent trip to Mexico.

*Hylodes Beatæ.*

Tongue oval, entire. Vomerine teeth in two oblique series behind the level of the choanæ. Snout pointed, projecting



beyond the mouth; canthus rostralis distinct; loreal region slightly concave; nostril near the end of the snout; interorbital space a little broader than the upper eyelid; tympanum very distinct, as large as the eye. Fingers and toes slender, with small terminal disks and very strong subarticular tubercles; first and second fingers equal; a very indistinct rudiment of web between the toes; two metatarsal tubercles, inner oval, outer smaller and round. Tibio-tarsal articulation reaching the tip of the snout or a little beyond. Small granular warts on the back, rest of body smooth. Dark brown above; a light bar across the interorbital region; a white, black-edged streak on the upper lip; limbs with dark, light-edged cross-bars; lower parts white, more or less speckled with brown. Male with two vocal sacs, indicated externally by a fold on each side of the throat.

From snout to vent 25 millim.

Two specimens, found by Dr. and Mrs. Gadow among dense shrub at La Perla, near Orizaba, at an altitude of 6000 feet.

Closely allied to *H. plicatus*, Gthr.

#### *Hylodes granulosus*.

Tongue nearly round, very indistinctly nicked behind. Vomerine teeth in two short transverse series behind the level of the choanæ. Snout rounded, scarcely projecting beyond the mouth, with obtuse canthus; loreal region concave; nostril near the end of the snout; interorbital space not quite so broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers and toes very slender, the tips dilated into very small disks; first finger extending beyond second; toes quite free, with very prominent subarticular tubercles; two metatarsal tubercles. Tibio-tarsal articulation reaching the tip of the snout. Upper parts granulate with small warts, lower parts smooth. Pinkish brown above, with darker markings; a )-( shaped dark marking on the occiput and the anterior part of the back, the lateral branches extending to the upper eyelid; sides of head with dark and light bars, radiating from the eyes; limbs with rather indistinct dark cross-bars; throat brown, dotted with whitish; belly whitish, speckled with brown.

From snout to vent 28 millim.

A single specimen from Santo Domingo, Carabaya, S.E. Peru, 6000 feet, collected by Mr. Ockenden.

*Hylodes platydactylus*.

Tongue nearly round, feebly nicked behind. Vomerine teeth in two small oblique groups behind the level of the choanæ. Snout rounded, scarcely projecting beyond the mouth, with obtuse canthus; loreal region concave; nostril near the end of the snout; interorbital region as broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers and toes moderately elongate, with large sub-triangular terminal disks; first finger not extending so far as second; toes quite free, with moderately developed sub-articular tubercles; two metatarsal tubercles, inner oval, outer round and very small. Tibio-tarsal articulation reaching between the eye and the tip of the snout. Upper parts nearly smooth; belly and lower surface of thighs granular. Brownish or greyish olive above, with symmetrical darker markings; a dark bar between the eyes, a W-shaped band behind the eyes and across the nape, oblique bands on the sides of the head and body and across the limbs; sometimes a yellowish vertebral band; lower parts whitish.

From snout to vent 32 millim.

Several specimens from Santo Domingo, Carabaya, S.E. Peru, 6000 feet, collected by Mr. Ockenden.

*Atelopus oxyrhynchus*.

Habit rather slender. Head longer than broad, its length contained twice to twice and a half in the length of the trunk, quite flat above, with vertical sides; snout pointed and strongly projecting; nostril midway between the end of the snout and the eye; interorbital space much broader than the upper eyelid. Fore limb long, slender in the female; fingers moderate, depressed, slightly swollen at the tips, first very short and broad, but well developed; carpal and subarticular tubercles indistinct; toes rather short, much depressed, about half webbed; metatarsal and subarticular tubercles indistinct. The tibio-tarsal articulation reaches the posterior border of the eye, or between the eye and the shoulder. Large smooth warts on the sides and posterior part of the body and on the limbs; belly granular or areolate. Coloration very variable. Some specimens uniform lemon-yellow, with or without a blotch of vermilion-red on the belly; others yellow above and orange-red below; others olive or olive-brown above, more or less spotted with dark brown and with a dark lateral streak extending to the end of the snout, lemon-yellow beneath, with

or without brown spots. Male with an internal subgular vocal sac.

From snout to vent 50 millim.

Numerous specimens from Venezuela (Rio Albirregas, Culata, Sierra Nevada de Merida), at altitudes of 10,000 to 11,000 feet, collected by Sr. Briceño.

*Atelopus erythropus.*

Habit rather slender. Head as long as broad, its length contained twice in the length of the trunk; snout as long as the eye, truncate, projecting beyond the mouth, concave above and on the sides; nostril a little nearer the end of the snout than the eye; interorbital space as broad as the upper eyelid. Fore limb long and slender; fingers moderate, depressed, slightly swollen at the tips, first very short; carpal and subarticular tubercles indistinct; toes rather short, three fourths webbed, inner very indistinct; metatarsal and subarticular tubercles indistinct. The tibio-tarsal articulation reaches the anterior border of the eye. Upper parts minutely granulate, lower smooth. Brown above, white beneath; lower surface of thighs and of feet vermilion.

From snout to vent 20 millim.

A single specimen from Santo Domingo, Carabaya, S.E. Peru, 6000 feet, collected by Mr. Ockenden.

*Rana Budgetti.*

Vomerine teeth in two transverse or slightly oblique series between the anterior borders of the choanæ. Head moderate, not much depressed; snout obtusely acuminate, as long as the orbit, projecting beyond the lower jaw; canthus rostralis obtuse; nostril a little nearer the eye than the end of the snout, followed by a rather deep concavity of the loreal region; interorbital space narrower than the upper eyelid; tympanum very distinct, as large as the eye. Fingers extremely short, blunt, first and second equal. Toes short, blunt, barely half webbed; subarticular tubercles small; a large, compressed, shovel-shaped inner metatarsal tubercle, its length equalling that of the inner toe. Tarso-metatarsal articulation reaching the nostril. Skin smooth on the back, warty on the sides; a dorso-lateral glandular fold, not connected with a similar fold above the temple. Pinkish grey above, with dark brown, black-edged spots, which are very crowded on the outer side of the dorso-lateral fold; a dark band on the side of the head, passing through the nostril, the eye, and the tympanum; limbs with regular cross-bars;

hinder side of thighs with dark vermiculation; lower parts white, with the exception of the throat and breast, which are grey, marbled with blackish and with two longitudinal white bands. Male with a large external vocal sac in a fold on each side of the throat.

From snout to vent 65 millim.

Four specimens (male and female and two young), from McCarthy Island, Gambia, presented by Mr. J. S. Budgett.

This species is very closely allied to *R. moeruensis*, Blgr., from Lake Mweru. It differs principally in the still shorter fingers, the first of which does not extend beyond the second.

### *Rana Swinhoana.*

Vomerine teeth in two oblique series between the choanæ. Head much depressed, slightly broader than long; snout as long as the diameter of the orbit, rounded; canthus rostralis obtuse; loreal region not very oblique, concave; nostril equally distant from the end of the snout and from the eye; interorbital space as broad as the upper eyelid; tympanum distinct, one half to three fifths the diameter of the eye. Fingers moderate, first not extending beyond second; toes entirely webbed; tips of fingers and toes dilated into well-developed disks, which are much smaller than the tympanum; subarticular tubercles rather small; a small, oval, inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout. Skin smooth, granular on the side; no dorso-lateral fold. Brown above, with small darker spots; a dark canthal streak and a dark temporal blotch; a whitish streak on the upper lip; limbs with rather indistinct dark cross-bars; lower parts white.

From snout to vent 80 millim.

Two female specimens from Bangkimtsing, Formosa, presented by Mr. J. D. La Touche.

The nearest ally of this species, named in memory of the late Robert Swinhoe, the first explorer of the Reptile-fauna of Formosa, is *R. livida*, Blyth (*chloronota*, Gthr.).

### *Hylambates cassinoides.*

Vomerine teeth in two small groups between the choanæ. Head as long as broad; canthus rostralis indistinct; tympanum about half the diameter of the eye. Fingers free, toes webbed at the base, dilated into small but very distinct disks; a moderately large oval metatarsal tubercle. Hind limb very short, the tibio-tarsal articulation reaching barely the axil. Skin smooth above; belly and lower surface of



thighs granular. Grey above, with six dark brown longitudinal stripes, the median pair narrowly separated; a dark brown canthal streak; limbs with regular dark brown cross-bars; lower parts white.

From snout to vent 46 millim.

A single female specimen from McCarthy Island, Gambia, presented by Mr. J. S. Budgett.

In form and markings this frog bears a remarkable similarity to *Cassina senegalensis*, D. & B., from which it is, however, easily distinguished by the terminal disks of the digits and the presence of a short web between the toes.

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LV.—On Haddonella Topsenti, *gen. et sp. n.*, the Structure and Development of its Pithed Fibres. By IGERNA SOLLAS.

[Plates XXVIII. & XXIX.]

OWING to the kindness of Dr. Harmer I have had the opportunity of looking through a collection of corals and sponges brought home by Dr. Haddon from Torres Straits. Amongst these was a single specimen of a ceratose sponge belonging to the Dendroceratina.

The sponge has been torn away from its earliest support, but remains attached to a piece of coral to which its distal parts have secondarily adhered. The proximal ends of the fibres project from the flesh, which has been dragged away from them; they are flattened and disk-like. The surface of the sponge is raised into conuli, which are widely separated at unequal distances from one another; a little below the summit of each the fibre which supports it can be seen through the flesh as a dark line. The general colour is a dull grey, tinged with pink (in spirit).

The oscula are covered by a sieve-like membrane. I prefer this method of stating the facts to saying that "the oscula occur in groups," seeing that each group of apertures leads into a single continuous cavity. The dermal ostia occur in patches, separated from one another by anastomosing strands of fibrous tissue, in close contact with the dermal membrane. The whole sponge is very cavernous. A six-rayed Ophiuroid was found in one of the internal passages.

The flagellated chambers measure about  $\cdot 07 \times \cdot 04$  mm. on an average and are elliptical in form, with wide mouths opening directly into the excurrent canals.

The general anatomy of the skeleton is shown in Pl. XXVIII. fig. 2; it consists of a number of separate fibres arising either singly or two or three together, from each disk of attachment. The fibres branch at intervals, the ultimate twigs either terminating within conuli or expanding, at the tip, into disks of attachment similar to those found at the proximal ends of the fibres. The minute structure of the fibres recalls that of *Ianthella*-fibres, for cells are present within their outer layers.

The diameter of the fibres in their oldest portions, near the base, is 0.72 mm.; commonly in the upper parts they measured 0.4 mm. in diameter.

As the genus *Ianthella* is the only sponge hitherto known to contain cells in the cortex of its fibres, I may here recall the more striking of the other characters common to all its known species. These are: the arrangement of the fibres into a regular square-meshed framework, horizontal fibres crossing others which rise vertically from a single basal disk, and secondly the restriction of oscula and ostia respectively to opposite sides of the plate-like sponge. Evidently the sponge now described cannot be included under the generic name *Ianthella*; I therefore propose to call it *Haddonella Topsenti*. Naturally up to the present *Ianthella* has afforded the only available material for studying the development of pithed sponge-fibres with cell-containing cortex. The first worker to give an account of the minute structure of the fibres and to discover the cells contained therein was Flemming (6) in 1872. The species he examined were *I. basta* and *I. flabelliformis*. He describes the fibres in each of these as consisting of a rose-red finely granular pith, surrounded by an amber-coloured cortex in which are embedded beautifully contrasting violet-red cells. The pith showed a lumen of small dimensions which was not a continuous canal, but occurred chiefly at the points where the fibres branch. The "Dornen" (small branches arising from the main fibres where these cross one another) were constantly free from cells at their apices. Flemming does not consider the question of the origin of the fibres or of their parts, but he goes only so far as to ask whether the cortical cells are proper to the sponge, or whether they are parasites, and decides that they are proper. In discussing the problem how, if they were parasitic, they could have got in, he mentions casually that the pith is naked at the apices of the "Dornen." He considers that the presence of cells in its fibres places the sponge in a very isolated position.

Carter (7) gives a general account of the skeletons of horny

sponges and discusses *Ianthella* at some length. He speaks of the cells in the fibres as "pigmented cells," and at one stage of his argument comes to this conclusion: "the horny laminæ were not only deposited on the grey granuliferous axis, but the horny material itself was formed by the pigmented cells." Carter, however, considers he is bound to reject this conclusion, because such a mode of formation of spongin is not known in other horny sponges, and he thinks that his choice of a spongin-former lies between the axis of the fibre and the surrounding "sarcode." He chooses the latter alternative. He has not seen, nor apparently sought, the fibre-tips.

Polejaeff (2) examined the species *I. flabelliformis*. He states that the cells in the fibres occur between the laminæ of spongin, as Carter had described it, the laminæ being concentric cylinders about the axis of the fibre, and he shows this well in his fig. 5, pl. 2. He speaks of the cells as in all probability spongoblasts, and he seems to have been the first to take this view. He failed to find any part of the fibre without cells or without spongin cortex, and consequently there was a difficulty in accounting for the origin of the pith. Polejaeff's work, 'On the Structure and Classification of Horny Sponges,' 1886, being written in Russian, was not accessible to me. In the 'Challenger' report Polejaeff speaks of the inclusion of spongoblasts in the horny substance of the fibres as a peculiarity of which the systematic importance is "rather ambiguous." He then remarks that "if we should in time find lanthellidæ, *i. e.*, horny sponges whose skeletal fibres are charged with true cells, of thoroughly different organization, we should be obliged to elevate the character in question to the rank of that of a subfamily, or even family" (p. 12).

Von Lendenfeld (3) describes three species, *I. flabelliformis*, *I. basta*, and *I. concentrica*. He criticizes Polejaeff's account and especially his fig. 5, pl. 2, which he says is very incorrect, and adds:—"The cavities" (*i. e.*, the cell-containing cavities in the cortex of the fibre) "are embedded in spongin which is clearly stratified in such a manner that the layers are *determined by the cavities* and strictly parallel to their surfaces" (the italics are his). The fig. 1, pl. 49, of the Monograph illustrates this statement clearly and shows a structure such as one might perhaps have expected on *à priori* grounds. The structure I have observed in the skeletal fibres of *Haddonella* agrees well with Polejaeff's figures, and with those published earlier by Flemming and Carter (6 and 7).

Von Lendenfeld describes the stratified spongin as passing

without any sharp limit into the granular pith which forms a thin layer. The inner surface of the pith is sharply defined: the pith is a hollow cylinder in which no cells of any kind can be distinguished. The difficulty of pith-formation he overcomes by a theory: he asserts that a cap of spongoblasts over the tip of the fibre secretes spongin, thus adding to the length of the fibre. This is afterwards destroyed by cells, the process being comparable to the formation of bone-marrow by osteoclasts, and the active cells are consequently termed "spongoclasts."

Minchin (4) relegates the whole matter of occurrence of cells in spongin-fibres to a footnote, saying that it is in need of re-investigation.

My own observations are as follows:—

The adult fibre shows, in cross or longitudinal section, three well-marked zones—(1) outermost, the cell-containing spongin-cortex, followed by (2) a layer of altered spongin-cortex, which surrounds (3) the pith: this may be solid, or having apparently yielded to tension may show a cleft-like cavity. (1) The cortex consists of cylindrical laminæ of spongin, which are all centred about the axis of the fibre, and of cells lying between the laminæ. The youngest cells on the periphery of the fibre are of large size, in close contact on all sides with spongin. They are of the same colour as the spongin, but many shades darker; the contrast which so pleased Flemming is absent here: the whole cortex is of the rich brown of spongin with a distinct tinge of violet superposed. The young cells are densely packed with spherical bodies; the nucleus is central and lies in a small clear space, which gives the cell the appearance of being perforated (fig. 6). The outer surfaces of the cells are convex. Proceeding from the periphery of a section towards the interior, the cell-bodies become continually smaller and the spherules in them less numerous, consequently the cells in the inner layers are no longer in close contact with the spongin, but come to lie in cavities. In the innermost layers there seems to be little besides nucleus remaining in these cavities, which, however, are never quite empty. (2) The second zone might be called a transition-layer: it is more or less granular, at the same time somewhat fibrillated and contains cells, or at any rate nuclei (figs. 8 & 9). It is easy to convince oneself that it is formed by alteration of the innermost cortical layers, and that the nuclei are the nuclei of cortical cells. (3) The pith is granular, homogeneous, and destitute of cells.

In the distal end of a growing fibre there are three regions



distinguishable, succeeding one another along its length. At the extreme apex is a region where the pith lies naked in the cap of spongoblasts. That Polejaeff overlooked this may be due either to the fact that the fibres he examined had ceased to grow, or it may be explained by irregularity of form or change of direction of the fibre. In the present material it is easy to obtain sections of an apparent apex (fig. 7), while the true growing point lies bent to one side and would appear many sections further on. I cannot say whether the same would be true of *Ianthella*.

In the second region, which is of varying length, the pith is covered with a single layer of spongin without cells embedded in it. This passes, by no means abruptly, into the cell-bearing region, which includes the whole of the older parts of the fibre. At first the cells are very sparsely scattered (figs. 4 & 7) and may be found outside the first-deposited layer of spongin, then included between the first two layers, with a second set of cells on the outside, and so on—always with cells on the outside as long as the fibre is still growing in thickness; when this growth has ceased the outermost layer is of spongin. From the rarity with which one finds cells on the outside of a fibre quite uncovered by spongin, one concludes that the deposition of this substance must take place rapidly.

The fibre-tips which are going to form adhesive disks differ from the ordinary tips in the great broadening of the pith at the apex and in the fact that the pith is quite without cell-covering over its flat distal surface. Accordingly, in the fully formed disk, the spongin which closes in the pith-cylinder at the extremity shows manifest signs of having arisen from secondary ingrowths from the spongin-cortex (Pl. XXIX. fig. 10).

The spongoblasts are many layers deep (Pl. XXVIII. fig. 5). Lower down on the fibre the layers are fewer and the cell-bodies larger, but still very much smaller than those of the cells applied to or included in the fibres and charged with spherules, between which cells and the ordinary spongoblasts outside the fibre I have looked for transition-forms in vain.

In material stained in bulk with Ehrlich's hæmatoxylin and afterwards well washed out with acid alcohol the spongin did not stain and lost its violet tinge, while both pith and transition-layer were well stained, particularly the latter.

In sections stained with iron hæmatoxylin (Heidenhain) the whole fibre was stained, and the nuclei in the transition-layer show up well after this treatment.

*Summary.*

(1) The new genus *Haddonella* has its nearest allies in the species of *Ianthella* (Gray); these two genera share the peculiarity of having cells in the cortex of their pithed fibres.

(2) The fibre-tips or growing points consist of naked pith alone, secreted by a many-layered cap of spongioblasts.

(3) Spongioblasts apply themselves sparsely to the sides of this pith, pouring out upon it a layer of spongin; upon this layer again spongioblasts settle and repeat the process of spongin deposition, and so on repeatedly till ultimately the pith is included in many successive sheaths of spongin, in the intervals between which the spongioblasts lie.

(4) The spongioblasts diminish in size and lose their granular contents in the process of forming the spongin layers.

The presence of cells in the spongin of sponge-fibres is a character of subfamily or family value (Polejaeff).

*Literature consulted.*

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## EXPLANATION OF THE PLATES.

All the figures refer to *Haddonella Topsenti*.

## PLATE XXVIII.

- Fig. 1.* Entire specimen, natural size, attached to a piece of coral.  
*Fig. 2.* Some skeletal fibres, partly diagrammatic.  
*Fig. 3.* Piece of the dermal membrane with dermal ostia and perforations of the oscular membrane.  
*Fig. 4.* Younger parts and apex of a growing fibre *in situ*.  
*Fig. 5.* Extreme tip of a growing fibre with spongioblast cap.  
*Fig. 6.* Cells from outer layers of the cortex of a fibre.  
*Fig. 7.* Longitudinal section of a fibre near the apex.  
*Fig. 8.* One side of the longitudinal section of a fibre.  
*Fig. 9.* Similar part of a section of an older fibre.

## PLATE XXIX.

- Fig. 10.* Longitudinal section of an adhesive disk.  
*Fig. 11.* Longitudinal section of a young stage in the development of an adhesive disk.

*a.*, algal cells which formed part of the surface of support; *a.d.*, disk

of attachment or adhesive disk; *c.*, cortex; *c.c.*, cortical cell; *d.o.*, dermal ostia; *f.c.*, flagellated chamber; *i.*, ingrowth of cortex; *p.*, pith; *p.o.s.*, perforation of the oscular sieve; *o.s.*, oscular sieve; *s.*, layer of spongo-blasts; *s.c.*, spongoblast cap; *tr.*, transition-layer.

Balfour Laboratory,  
Cambridge, 1902.

LVI.—*Description of a new Genus of Heteromerous Coleoptera*. By CHAS. O. WATERHOUSE, F.E.S.

**Tenebrionidæ.**

*APOCRYPHINÆ.*

**PLASTICA, gen. nov.**

Mentum trapezoidal, the angles slightly acute; ligula strongly exerted, narrowed towards the base, truncate in front (with two points of the hypopharynx projecting beyond it in the specimen examined); labial palpi short, the apical joint moderately large, somewhat ovate, a little narrowed towards the apex, which is slightly obliquely truncate. Maxillæ with the inner lobe furnished at the apex with numerous curved bristles, one of which is much larger than the others. Maxillary palpi large, the apical joint securiform. Mandibles bifid at the apex. Labrum prominent. Antennæ moderately long, stout, pubescent, slightly thickened towards the apex. Head somewhat quadrate, swollen behind the eyes; epistome oblique at the sides, very slightly sinuate in front. Antennary orbits somewhat swollen. Eyes small, scarcely prominent, very coarsely faceted. Thorax subquadrate narrowed at the base, with all the angles much rounded; the sides confounded with the under flanks. Scutellum small, indistinct. Elytra oblong-ovate, convex, dorsally flattened, with the suture impressed. Legs moderate; the front and middle femora much thickened at the middle; the posterior pair only gradually narrowed to the base, thick at the apex, with a rather deep emargination below at the apex, so that there is a distinct angle produced below. Tarsi hairy below; anterior with the basal joint a little longer than the second, which is (like the third and fourth) short; the posterior tarsi are rather longer, with the basal joint moderately long, longer than the second and third together. The anterior coxæ are globose and prominent. The sternal process not very broad, almost vertical posteriorly. The intermediate coxæ not very widely separated. Metasternum very short. Abdomen with the intercoxal process broad; the first and second segments subequal, the suture

dividing them not very well marked, the third segment only a little shorter; the fourth about two thirds the length of the third, more convex in the longitudinal direction, with the sutures dividing it from the others more strongly marked\*.

This genus is closely allied to *Apocrypha*, but differs in having the femora less club-shaped, with the posterior pair emarginate at the apex below; the proportions of the joints of the tarsi are also different.

The insect somewhat resembles some species of the Carabideous genus *Bradycellus*.

*Plastica polita*, sp. n.

Elongato-oblonga, piceo-nigra, nitidissima; capite crebre fortiter punctato; thorace minus crebre sat fortiter punctato; elytris irregulariter punctatis, sutura prope scutellum impressa; pedibus rufo-piceis.

Long. 5 mill.

*Hab.* Sorata Mountain (*Sir Wm. Martin Conway*).

Head rather large, subquadrate, the punctures rather large and close together, leaving a smooth spot on the vertex. Cheeks behind the eyes swollen almost to the level of the eye, parallel, with the angles much rounded. Antennæ reaching to about the middle of the thorax, rather stout, slightly thickening towards the apex; the third joint a little longer than the second; the following joints short, gradually becoming transverse, the eleventh joint nearly twice as long as broad, conico-ovate. Thorax only a little broader than the head, one-sixth broader than long, evenly convex, scarcely narrowed in front, but considerably narrowed at the extreme base, the sides gently rounded and with the angles rounded. The surface is very distinctly punctured, but not so strongly as the head, and the punctures are separated from each other by the diameter of a puncture. Elytra at the shoulders scarcely wider than the thorax, slightly wider posteriorly, arcuately narrowed at the apex, more finely punctured than the thorax, the punctuation not very sharply defined, irregular, moderately close, with some very lightly impressed punctured lines, especially near suture and sides. The shoulders are very much rounded; the apex is tinged with pitchy red. Legs not very long; the tarsi about as long as the tibiæ.

\* While examining the mouth-parts of this genus I looked at those of *Hymæus*, Pasc., which is placed next to *Apocrypha*; finding them unlike those of a Heteromerous insect, I examined the tarsi, and found the joints to be 5, 5, 5 in the first specimen; but the second is a male, and has them 5, 5, 4, showing that the genus should be placed in the Cucujidæ, perhaps near *Psammæchus*.



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LVII.—*On some new Genera and Species of Parasitic Hymenoptera from the Khasia Hills, Assam.* By P. CAMERON.

[Concluded from p. 371.]

### *Acanthojoppa apicilineata*, sp. n.

Luteous; two small marks on the pronotum in front, a band round the base of the mesopleuræ, continued under the tubercles, a mark in front of the middle coxæ, the base and underside of the metapleuræ, the scutellar depression, the base of the median segment, and the posterior median area, black. Wings hyaline, the stigma pale testaceous. ♀.

Length 11 millim.

*Hab.* Khasia. Coll. Rothney.

Apex of antennæ broadly fuscous. Face closely, distinctly, and uniformly punctured; the clypeus obscurely punctured above; the front and vertex closely punctured, the former with a smooth shallow line down the middle. Mesonotum closely and uniformly punctured; the scutellum is more strongly and not so closely punctured on the basal slope, which is thickly covered with fuscous hair; its sides, on the basal slope, are keeled; the apex on the top is slightly roundly depressed; viewed from the sides the

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scutellum is triangular, the basal and apical slopes being straight and oblique. Basal areæ of median segment closely punctured, the middle obliquely, the apical more strongly transversely striated; the areola is twice longer than broad; the spines are sharply pointed, long; the part outside them is coarsely striated; the rest of the spiracular area is closely punctured. The second and third abdominal segments are minutely and closely punctured. Gastrocœli curved, deep, narrow. The sheaths of the ovipositor are distinctly longer than the last segment, which is longer than the penultimate.

*Acanthojoppa nigromaculata*, sp. n.

Luteous; the basal sixteen joints of the antennæ more yellowish in tint towards the middle; the others infuscated. The inner and outer orbits broadly, the greater part of the clypeus, the mandibles, and the pleuræ, pale yellow; the apex of the mesonotum, a mark longer than broad on the basal half of the scutellum, the base of the median segment all round, the posterior median area, a line below the tubercles and one over the hinder coxæ, black; the four front coxæ are of a paler yellow tint. Wings hyaline, the basal half has a fulvous tinge; the stigma testaceous, the nervures blackish. ♀.

Length 16 mm.

*Hab.* Khasia. Coll. Rothney.

May be known by the small size of the areola; it is broader than long, rounded behind, and bears some stout central and a few oblique lateral keels. Face punctured, but not very closely; the upper part of the clypeus sparsely punctured; both are covered with pale hair; the vertex is closely punctured and covered with shorter darker hair. Mesonotum coarsely shagreened; the scutellum is closely and distinctly punctured above and thickly covered with blackish hair. Postscutellum smooth; the basal foveæ deep and clearly defined. The base of the median segment is closely punctured; the posterior areola is rather small, broader than long, rounded behind, transverse at the apex; the apical areæ are coarsely transversely striated; the base of the spiracular closely punctured; the rest obliquely stoutly striated; the spines are longer than broad and gradually narrowed towards the apex. Propleuræ smooth, except for some striæ on the centre of the apex; the mesopleuræ closely punctured at the base and apex, and with a broad belt of oblique striæ in the middle; the metapleuræ closely striated, less distinctly towards the apex. The second

abdominal segment is distinctly punctured; the gastrocœli shallow, with a few stout longitudinal striæ.

*Acanthojoppa nigrolineata*, sp. n.

Ferruginous; the scape of the antennæ and the four or five basal joints of the flagellum rufous, the rest black; the face, clypeus, mandibles, except at the base, and postscutellum, a line on the upper half of the propleuræ, the base and upper half of the mesopleuræ under the wings, the base of metanotum all round, the lower part of the metapleuræ, the posterior median area and the apex of the median segment, and the sides of the petiole for the greater part, black. Legs coloured like the body, the four front coxæ pale yellow, the hinder largely black on the outer side at the apex and the hinder tarsi black. Wings fulvous, the apex from the base of the stigma fuscous violaceous; the stigma and the apical nervures dark testaceous. ♂.

Length 15 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus strongly punctured, the latter with a shallow depression in the middle at the apex; both are thickly covered with long white hair; the labrum fringed with long white hair. Mesonotum closely punctured and thickly covered with short black hair. The top of the scutellum has a slight but distinct broad depression; the basal slope punctured and thickly covered with long fuscous hair. Postscutellum smooth, pale yellow. The basal slope of the median area in the centre is bordered all round by a stout keel; the areola is about as long as it is wide in the middle; the apical half is obliquely narrowed, the posterior median, except at the base, is irregularly transversely striated; the spines are stout and narrowed towards the top, which is bluntly rounded. Pleuræ closely punctured, the metapleuræ more strongly than the rest, especially on the basal half. Gastrocœli with the basal half deep and irregularly transversely striated.

*Acanthojoppa curtispina*, sp. n.

Rufous, the face and clypeus pale yellow; the middle of the mesonotum, a line on the sides, a darker one alongside the tegulæ, the scutellar depression, the base of the median segment, the base and upper part of the mesopleuræ below the tubercles, and the base and lower side of the metapleuræ, black. Wings hyaline, iridescent, the base with a slight fulvous tint, the apex with a faint but distinct fuscous cloud;

the stigma dark testaceous, the nervures black. Antennæ rufous, darker at the apex, the scape black in the middle beneath. ♂.

Length 13 mm.

*Hab.* Khasia. Coll. Rothney.

Face closely and rather strongly punctured; the apex of the clypeus depressed; both are covered with short white hair. Vertex and middle of the front punctured and covered with short dark hair. Mandibles pale yellow, their teeth black. Mesonotum closely punctured. Scutellum strongly but not very closely punctured, and thickly covered with long fuscous hair, its sides sharply keeled, its apex only very slightly depressed. The base of the median segment rugosely punctured; the areola is about as long as broad, slightly obliquely narrowed behind laterally, and not bordered by a keel there; it is coarsely, irregularly, transversely striated; the posterior median area is closely and finely rugose, the lateral irregularly reticulated. The upper part of the propleuræ closely punctured, behind, in the middle, obliquely striated. Mesopleuræ closely punctured and with a striated band in the middle below. Metapleuræ closely rugose. The sides of the postpetiole punctured; the second and following segments closely punctured; the gastrocœli narrow and bearing one or two striæ on the base.

*Xestojoppa bilineata*, sp. n.

Yellow; the ocellar region, a band on the front (the black on the former roundly narrowed before and behind, on the latter widened below), an oval ring above the antennæ with a black mark inside, two broad lines on the sides of the mesonotum (not reaching to the outer edge and reaching to the middle), the area on the median segment, and the base of the second abdominal segment, black. Legs coloured like the body, the base of the hinder femora black. Wings almost hyaline, the stigma dirty yellow. ♀.

Length 15 mm.

*Hab.* Khasia. Coll. Rothney.

Head smooth and shining; the clypeus sparsely punctured. Apex of antennæ broadly black. Mesonotum closely punctured. Scutellum almost impunctate; the sides of the postpetiole striated at the base. Median segment closely rugosely punctured, its area irregularly longitudinally striated; the teeth are longish and do not project much. Abdomen smooth and shining; the middle of the petiole is marked with fuscous. Antennæ pallid yellow, the apex broadly black.



*Xenojoppa? maculiceps*, sp. n.

Length 11 mm. ♂.

Hab. Khasia. Coll. Rothney.

This species agrees with *Xenojoppa*, except that there is no spine on the hinder coxæ.

Black; the face (except for a black line down the centre), the inner orbits to the lower ocelli, a spot behind the eyes, the clypeus (except at the apex), a line on the hinder part of the pronotum (narrowed in front), a line on the side of the mesonotum, the scutellum (except for a triangular mark on the sides at the base and a square mark in the middle behind), the postscutellum, the tubercles, the lower part of the pronotum, the hinder half of the propleuræ below, a mark on the lower side of the mesopleuræ at the base and extending on to the sternum, a small mark on the meta-pleuræ below, the postscutellum, the basal half of the first, its apex, and the apices of all the other abdominal segments, yellow. Legs fulvous, the four anterior more yellowish in tint, the hinder femora and tibiæ rufous; the hinder coxæ black, yellow in front and in the middle behind; the hinder trochanters marked with black; the apex of the hinder femora, the base of the hinder tibiæ narrowly, and their apex broadly, black. Wings hyaline, the stigma and nervures black; the areolet is almost appendiculated. Antennæ longer than the body, black, a broad yellow band beyond the middle; beyond the middle the joints are serrate and thickly covered with black hair. Thorax as long as the abdomen; on the basal edge of the mesonotum is a row of foveæ; the sides and apex of the middle lobe are bordered by irregular keels and furrows. Scutellum covered with long black hair, strongly keeled laterally, the keels at the base forming a triangular depression; the apex is depressed; the postscutellum smooth. The areola is broader than long, its basal two thirds obliquely narrowed; its base is smooth, the rest irregularly longitudinally striated; the central keel is continued to the base; the posterior median area is clearly defined, its base irregularly reticulated, the rest of it (as are also the lateral areæ) stoutly transversely striated. Apex of propleuræ striated; the mesopleuræ smooth above, the lower part strongly and closely punctured; the metapleuræ strongly and closely reticulated. The second and third abdominal segments are closely punctured, striated at the base; the gastrocœli deep, longish, brownish, bordered outwardly by keels.

*Habrojoppa leucozona*, sp. n.

Blue, the face, clypeus, the inner orbits narrowly to the lower ocellus, the base of the mandibles broadly, the palpi, the scutellum (except at the base), the basal third and the apex of the first abdominal segment, the base of the second and its apex broadly, yellow. The antennæ black, the fourteenth to twentieth joints white below. Legs blue, the anterior fulvous, their coxæ and trochanters white, marked with black behind, the hinder trochanters and base of femora rufous below; the calcaria dark testaceous. Wings fuscous hyaline, the stigma black, the nervures fuscous. ♀.

Length 15 mm.

*Hab.* Khasia. Coll. Rothney.

Head densely covered with short white hair. Face and clypeus closely punctured, the front and vertex smooth. Mesonotum coarsely, rugosely, irregularly reticulated. Scutellum smooth. Postscutellum striated. Median segment strongly irregularly reticulated; the areola longer than wide, bulging out at the sides, smooth, and with a keel down the centre. Lower part and apical portions of propleuræ closely striated; the upper part of the mesopleuræ with curved longitudinal striæ, all clearly separated, the lower closely punctured. Petiole smooth, the base of the second segment striated; the gastrocoeli large, not very deep, and striated at the base.

*Habrojoppa maculiceps*, sp. n.

Blue; the inner and outer orbits, the face and oral region, the apex of the scape, a broad band on the middle of the flagellum, the clypeus, the edge of the pronotum, the basal half and the apex of the petiole, the apex of the second abdominal segment, of the fourth to the seventh, the sides of the third, and the apical half of the last segment, yellow. Legs rufo-fulvous, the middle coxæ and trochanters yellow, the hinder coxæ blue except at the apex; the apical third of the hinder femora and tibiæ, the base of the hinder tibiæ, and the apical two joints of the tarsi are black. Wings clear hyaline, the stigma testaceous; the arcolet narrowed above. ♀.

Length 12 mm.

*Hab.* Khasia. Coll. Rothney.

Head shining; on the face is a somewhat mitre-shaped black mark, which is prolonged along the top of the clypeus. Mesonotum coarsely and closely reticulated in the middle, bordered on the outer side by stout keels, and inwardly is

marked by transverse keels. Scutellum smooth, its depression black. Postscutellum deeply depressed in the middle, the depression bordered by stout keels; outside is a stout oblique keel, followed by a similar one. Median segment closely reticulated; the middle keel extends to the apex; the bordering keels are curved outwardly at the base. There is a striated band on the upper part of the propleuræ; the apex is more narrowly striated. Mesopleuræ below the tubercles with a few perpendicular striæ; above the middle are four longitudinal ones, the upper being stouter than the lower. Metapleuræ closely and strongly punctured; below the spiracles is a smooth keel. Second abdominal segment strongly longitudinally striated on the blue part; the third is much less strongly longitudinally striated; the other segments smooth, the ventral largely marked with yellow.

*Dimætha flavinerva*, sp. n.

Luteous; the face yellow, the mandibular teeth, the vertex behind and the ocellar region, the basal third of the third, the fourth with slightly more than the basal half, and the other abdominal segments entirely, black. The four front legs entirely luteous, their coxæ paler, more yellowish, the hinder pair black; the hinder legs black, the coxæ, trochanters, and somewhat more than the basal half of the femora, rufous. Wings yellowish hyaline, the apex from the end of the areolet fuscous violaceous. Antennæ black, brownish beneath, the scape yellowish. ♀.

Length 20 mm.

*Hab.* Khasia. Coll. Rothney.

Face closely punctured, the clypeus more shining and less closely punctured. Labrum fringed with long fulvous hair. Palpi fuscous and covered with short white hair. Front closely, almost rugosely punctured, the vertex strongly punctured; the inner orbits sharply margined. Mesonotum dark rufous, closely rugosely punctured. Scutellum thickly covered with long fuscous hair; the basal depression deep, stoutly keeled. Postscutellum finely punctured and thickly covered with fuscous hair. The middle of the median segment is transversely striated, the rest rough, rugose, irregularly reticulated. Propleuræ striated, more coarsely and running into punctures above. Mesopleuræ coarsely punctured, the lower part at the base with some stout striations. Metapleuræ rugosely punctured, the lower part bordered by a wide and deep crenulated furrow and at the apex with some stout oblique keels. The narrowed part of the first abdo-

minal segment slightly, the apical strongly punctured ; the other segments closely punctured, the punctuation becoming weaker towards the apex, the second striolated at the base. Gastrocœli large, curved, smooth at the base and bottom.

*Dimætha nigrolineata*, sp. n.

Ferruginous ; the second, third, and fourth abdominal segments black at the base, the apical entirely black, the face, clypeus, labrum, mandibles, and palpi yellow ; the ocellar region and the occiput in the centre black, the orbits yellow ; the front rufous and with two sharp stout keels in the middle, running down from the ocelli and converging below ; the four front legs rufous, their coxæ paler, more yellowish, slightly more than the apical half of the hinder femora, slightly more than the apical half of the hinder tibiæ, and the hinder tarsi, black. Wings yellowish hyaline, the costa and stigma rufo-fulvous. ♂.

Length 20 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus punctured, the latter more strongly than the former, the labrum more finely and closely. Antennæ black, the scape yellow. The lower part of the pleuræ and the sternum are paler, more yellowish than the mesonotum, which is closely and strongly punctured and thickly covered with longish black hair. Scutellum pyramidal, oblique, strongly punctured (except at the top), which ends in a somewhat triangular point and is thickly covered with long fuscous hair. Postscutellum very smooth and shining and with an obliquely rounded slope. The raised obsolete areola smooth ; from it run two stout acute keels to the apex of the segment, the keels becoming larger and more acute towards the apex ; the sides are bordered by a curved, more irregular keel ; the base is coarsely rugosely punctured, the punctures running into reticulations ; the apex is more stoutly transversely striated ; the spiracular region coarsely rugosely reticulated, and bordered on the outer side by a smooth keel ; the segment is covered closely with longish black hair. Propleuræ punctured above. Mesopleuræ with a long sharp keel at the tubercles, above with shallow punctures, the middle more strongly punctured, the punctures on the lower part running into strong longitudinal striations. Metapleuræ (except at the base above) strongly punctured ; shortly below the middle is a stout curved keel ; the base, apex, and lower part bordered by a narrower keel, the two forming a large enclosed area. Petiole above coarsely punc-



tured, especially at the apex; the latter is raised in the middle, this part being bordered by keels; the spiracles are bordered behind by a stout curved keel. Gastrocœli wide, deep, smooth, striated on the bottom; the latter and the sides are black, the segment between them is stoutly and sharply striated; the petiole on the lower side is stoutly keeled, the keels bifurcating at the apex.

*Charitojoppa varicolor*, sp. n.

Rufous, marked with blue; the mandibles, palpi, the sides of the pronotum (except at the base), tubercles, base of tegulæ, sides of scutellum broadly, the lower third of the pro- and mesopleuræ, two lines on the mesosternum, the narrowed base of the first, its apex and the apices of the other abdominal segments, yellow. Abdomen blue, rufous between the gastrocœli. Legs rufo-fulvous, the anterior paler; the four anterior coxæ and trochanters pale yellow, the hinder coxæ reddish brown; the apex of the hinder femora and of the hinder tibiæ black. Wings hyaline, the stigma black. ♀.

Length 14 mm.

*Hab.* Khasia. Coll. Rothney.

Head brown, the vertex in the middle and the orbits on the top behind blue; the front and vertex smooth; the centre of face strongly punctured, rufous, mixed with blue. Clypeus sparsely punctured. Middle of mesonotum strongly reticulated; the centre at the base depressed; there is a smooth longitudinal space on the sides inside the margined furrow. Scutellum shining, the basal slope smooth; the lower part on the sides widely furrowed; the apical slope widely furrowed in the centre, the furrow triangularly narrowed at the top and bottom. Postscutellum smooth, its centre and sides obscurely keeled. Areola smooth and shining; the keels bounding it curve outwardly, then diverge outwardly to the sides of the apex of the segment confluent with the posterior median area; the basal areæ large and roundly dilated on the outer side at the apex; they are irregularly striated, smooth on the outer side; the rest is strongly transversely striated, the striæ running into reticulations in places; in the central part of the apex are two longitudinal keels, forming an area divided by keels into three parts. The upper and hinder part of the propleuræ strongly striated. Mesopleuræ irregularly and strongly striated except in the centre behind. Metapleuræ closely reticulated. The second abdominal segment is

rufous between the gastrocoeli, which are striated and yellow at the base, smooth and blue at the apex. The third segment is closely punctured, the others smooth.

*Lamprojoppa fuscinerva*, sp. n.

Blue; the antennæ black, fuscous towards the apex; at the foot of the eyes is a broad dirty white band, which is continued more narrowly round the base of the mandibles. Legs thickly covered with black hair, the tarsi black, the tibiæ darker than the femora. Wings hyaline, the stigma and nervures fuscous; the areolet almost appendiculated, oblique. ♀.

Length 15 mm.

*Hab.* Khasia. Coll. Rothney.

Head sparsely covered with short white hair, the front broadly in the middle transversely striated, its sides sparsely punctured; the ocellar region more strongly and closely punctured; the inner orbits are sharply margined; clypeus and face strongly and closely punctured and thickly covered with white hair. Mesonotum strongly and closely punctured; the sides of the middle lobe at the base transversely striated. The central part of the scutellum bears large scattered punctures. Median segment coarsely transversely striated. Areola transverse at the base, at the apex obliquely narrowed; inside is a stout central and two shorter lateral keels; the teeth are large, broad, rounded; the posterior median area is smooth at the base (except for a central longitudinal keel); the basal lateral areæ bear large, deep, round punctures; the spiracular area strongly irregularly reticulated. Pleuræ strongly and closely punctured, the sutures striolated. Petiole smooth, the postpetiole in the middle transversely striated; the second segment is strongly, the third and fourth less strongly, punctured. Gastrocelli large, deep, their base stoutly striated.

*Ileanta trochanterata*, sp. n.

Black; the edge of the pronotum, the scutellar keels broadly, the sides and apex of the scutellum, the post-scutellum, an irregular mark on the median segment above the areola, its apex and two oblique marks above it, these being prolonged upwards from beneath on the outer side, the lower side of the mesopleuræ broadly, the yellow being prolonged on to the sternum on the basal half, and a band above the hinder coxæ, yellow. Head smooth and shining, black, below the antennæ on the inner and outer sides, and

the orbits narrowly above, whitish yellow; the apex of the mandibles broadly black. Wings hyaline, the costa and nervures black, the stigma fuscous. The four front legs are yellow, the third and fourth joints of the anterior tarsi, the middle pair almost entirely, the hinder coxæ, femora, tibiæ, and tarsi, black; the hinder calcaria white. Abdomen black, the lower side, base, and apex of the petiole, the sides of the postpetiole more broadly than the middle, a large mark near the apex of the second segment, triangularly narrowed behind, a large mark (narrowed on the inner side) on the sides of the third and fourth (the mark on the fourth being the smaller), the fifth except at the base laterally, and the sixth entirely, pale yellow. ♀.

Length 17 mm.

*Hab.* Khasia. Coll. Rothney.

This species differs from *I. latitarsis*, Cam. (Manch. Memoirs, 1899, p. 205), in the transverse cubital nervures being united above. The generic characters may be supplemented. The labrum projects; the clypeal foveæ are distinct, the occiput is margined, the postscutellum depressed at the base laterally, the base of the median segment is obliquely depressed; the ventral fold extends from the base of the second to the apex of the fourth segment; there are eight dorsal segments on the abdomen, the last being minute; the ovipositor projects; the apices of the joints of the hinder tarsi are spinose; the claws are large. The metatarsus is not quite so much dilated as in *I. latitarsis*; the cheeks are flat, the face only very slightly developed; the middle abdominal segments are slightly angularly produced laterally; the striæ only extend to the apex of the fourth segment; the gastrocœli large and deep; and the antennæ are distinctly dilated.

*Ileanta fulvipes*, sp. n.

Black; the face, clypeus, labrum, the inner orbits, the outer narrowly above, the malar space for the most part above, the base of the pronotum, its edge above from near the base, the base of the tegulæ, the scutellar keels, the apex of the scutellums, an oblique line on either side of the apex of the metanotum, a mark behind the spiracles, the lower third of the mesopleuræ, a line down their apex, the sides of the basal four segments of the abdomen broadly at the apex, a smaller mark on the sides of the fifth, a transverse narrow one on the apex of the sixth, and the greater part of the seventh, pale yellow. Wings clear hyaline, the stigma and nervures black. Legs fulvous, the four front coxæ and

trochanters pale yellow; the hinder coxæ black, yellow at the base above; the apical half of the hinder femora, the extreme base of the hinder tibiæ and the apex more broadly, black; the hinder tarsi pale yellow. Antennæ black; a mark on the base and apex of the scape beneath, and the seventh to eighteenth joints of the flagellum beneath, white. ♀.

Length 16 mm.

*Hab.* Khasia. Coll. Rothney.

Face sparsely punctured; on its centre are two black lines; the clypeus almost smooth, both are sparsely haired. Mesonotum raised in the middle at the base and thickly covered with short black hair; the middle at the base closely, the sides and apex sparsely, punctured. Metanotum strongly and closely punctured (except on the sides at the base); the areola is elongate, about three times longer than broad; its centre smooth, its sides irregularly striated; it is open behind. The flat scutellum is sparsely punctured. Pro- and mesopleuræ closely punctured except in the middle; the metapleuræ closely and regularly punctured. The basal three segments of the abdomen are closely longitudinally striated in the middle.

*Eutanyacra stramineomaculata*, sp. n.

Black; the inner orbits, the face, clypeus, labrum, the base of the mandibles broadly, a line on the pronotum, the tubercles, the scutellums, the apex of the first (narrowly in the middle, broadly on the sides), a large mark on the sides of the second and third at the apex, almost the apical half of the sixth, and the apical two thirds of the seventh abdominal segments, lemon-yellow. Legs lemon-yellow, the four front coxæ at the base, the hinder entirely, the four anterior femora except at the apex, the hinder entirely, the apical third of the hinder tibiæ, the apical joint of the tarsi entirely, and the apices of all the others, black. Wings hyaline, with a slight fulvous tinge. The underside of the scape and the seventh to thirteenth antennal joints yellow. ♂.

Length 16 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus closely and strongly, the front and vertex less strongly, punctured and thickly covered with white hair; in the middle of the face is a black line, the upper half of which is dilated. Pro- and mesothorax closely punctured, thickly covered with short pale hair; the scutellum is not quite so closely, the median segment more coarsely rugosely,



punctured, its apex transversely striated; the striæ on the posterior median area are more regular and not so coarse as on the lateral area. Areola about as broad as long, its apex rounded inwardly. Postpetiole closely and finely rugose, the punctures in the middle running into curved striæ; the second, third, and fourth segments are closely punctured.

Differs from *E. pallidicoxis*, Cam., in the yellow markings being straw-yellow, in the four front femora being broadly black, in the four front coxæ being only yellow at the apex, in the cubitus not being sharply angled at the stump of a nervure which is almost obsolete, in the postpetiole being more distinctly separated from the petiole, which is longer and narrower.

#### HERESIARCHINI.

##### *Setanta femoralis*, sp. n.

Black; the face, the inner orbits, the lower half of the outer broadly, clypeus, labrum, palpi, mandibles, the edge of the pronotum, two short lines on the centre of the mesonotum, the scutellums, two (somewhat large) marks on the sides of the metanotum covering the spines, the lower edge of the propleuræ, the tubercles, the lower part of the mesopleuræ, the apex of the petiole (broader at the sides than in the centre), a large mark (obliquely truncated on the inner side) on the sides of the second and third abdominal segments at the apex (the mark on the second being much the larger), a narrower line on the fourth, the entire apex of the fifth and sixth, and the seventh almost entirely, pale yellow. Legs dark rufous, the four anterior coxæ and trochanters pale yellow, the hinder coxæ black, with a large yellow mark above on the apex, the basal joint of the trochanters black, the apical two thirds of the hinder femora, the apex of the tibiæ, and the tarsi (except at the base) black. Wings clear hyaline, the stigma and nervures black. ♀.

Length 11 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus closely and strongly punctured, the face covered with short white pubescence, the clypeus with longer fuscous hair. The centre of the vertex and of the front distinctly punctured; there is a shallow triangular depression below the ocelli. The tenth to the fifteenth joints of the antennæ white beneath. Mesonotum shining, thickly covered with short white pubescence. Metanotum closely rugosely punctured, the apex closely transversely rugose; the areola longer than broad, transverse at the base and

apex, the sides bulging outwardly. Pleuræ closely punctured, the metapleuræ more closely than the rest, the lower part of the propleuræ striated.

May be known from *S. rufipes*, Cam., by all the femora being for the greater part black, by the marks on the metanotum being straight and oblique on the top, instead of the inner three fourths being rounded and raised above the outer edge, the base of the tibiæ pale, not bright red, and there is no yellow on the scape of the antennæ, the flagellum, too, being darker coloured.

*Chiaglas longicornis*, sp. n.

Black; the scape of the antennæ below, joints 9-16, and the base of the mandibles, white; the scape for the most part testaceous and thickly covered with fulvous pubescence; the face, clypeus, the inner orbits to the end of the eyes, the lower half of the outer to the mandibles, the palpi, the edge of the pronotum, the scutellums, the sides of the apical slope of the median segment (including the spines), the tubercles, the centre of the lower part of the mesopleuræ, their upper edge, the apex of the first segment narrowly, of the second and third more broadly, of the fourth to sixth more narrowly, and the seventh and eighth entirely, pale yellow. Legs rufous, the coxæ and trochanters pallid yellow; the hinder coxæ black, with a broad, oblique, yellow band on the top, the hinder trochanters yellow, the apical third of the femora, the apex of the tibiæ more narrowly, and the tarsi, black; the calcaria pale. Wings hyaline, with a slight fulvous tinge; the stigma testaceous, the nervures darker. ♀.

Length 13 mm.

*Hab.* Khasia. Coll. Rothney.

Face and top of clypeus closely punctured and covered with short pale hair; the apex of the clypeus black. Mesonotum closely punctured all over and thickly covered with short fuscous pubescence, as is also the scutellum, which is sparsely punctured. Median segment closely punctured and thickly covered with pale pubescence; the punctures on the sides run into reticulations; the areola is longer than broad, not much narrowed towards the apex, its base rounded; it is rugose, its base, apex, and, to a less extent, the sides are irregularly striated; the posterior median area transversely closely striated. Pleuræ closely but not strongly punctured, the mesopleuræ with a plumbeous hue, the base finely, the lower half of the apex more strongly, striated; the metapleuræ more closely and strongly punctured, the centre closely striated. Postpetiole closely, minutely, longitudinally striated. Gastrocœli closely striated.

*Chiaglas tinctipennis*, sp. n.

Black ; the scape below, joints 12–19 of the antennæ, and the base of the mandibles, white ; the face, clypeus, the inner orbits, and the outer from the middle of the eyes to the base of the mandibles broadly, the edge of the pronotum, scutellums, a mark on the sides of the upper part of the metanotum, extending on to the pleuræ, the tubercles, a squarish mark on the base of the mesopleuræ below the middle, the part below the hind wings, and the apices of all the segments and the base of the second, pale yellow. The four front legs fulvous, the coxæ and trochanters pallid yellow, the apex of the fore tarsi, and the whole of the middle, black ; the hind legs black ; a large oblique mark on the basal half of the coxæ above and the basal joint of the trochanters pale yellow ; the base of the hinder tibiæ broadly testaceous on the underside, extending to beyond their middle ; the calcaria pale yellow. Wings hyaline, with a slight but distinct fuscous-violaceous tinge ; the stigma and nervures black. ♂.

Length 13–14 mm.

*Hab.* Khasia. Coll. Rothney.

Face strongly and closely punctured ; the clypeus sparsely punctured round the top, the depressed centre smooth ; the extreme apex of the clypeus black, its depressed centre smooth ; both are covered with pale pubescence. Mesonotum closely punctured and thickly covered with short pale down. Scutellum thickly covered with long pale hair. Median segment closely and strongly punctured, the punctures running into striæ. The areola large, slightly longer than broad, closely, irregularly, rugosely reticulated, the sides furrowed to shortly beyond the middle ; the base is rounded backwards, as is also the apex ; the posterior median area is closely, strongly, transversely striated, its base irregularly punctured. Pro- and mesopleuræ smooth and with a plumbeous hue ; the metapleuræ closely and strongly punctured, more strongly on the apex than behind.

The yellow bands on the second, third, and fourth abdominal segments are dilated at the sides, that on the last extends to near the middle.

Comes near to *C. nigripes*, which is larger, has the face marked with a triangular black mark ; the mesopleuræ distinctly punctured all over, the areola not clearly longer than broad and not rugosely coarsely punctured, and the four front legs in *tinctipennis* are distinctly fulvous, not pale yellow.

*Chiaglas longiventris*, sp. n.

Length 16 mm.

*Hab.* Khasia. Coll. Rothney.

A larger species than *C. varipes*; the differences between the two may be expressed thus:—

The upper half of the posterior median area not hollowed ; the hinder coxæ black, yellow at the base above . . . .	<i>varipes</i> .
The upper half of the posterior median area hollowed ; the hinder coxæ yellow above, black at the base below, the apex rufous . . . . .	<i>longiventris</i> .

Black; the apex of the scape and joints 8–16 of the flagellum of the antennæ, the inner orbits to the ocelli narrowly, the lower half of the outer entirely, the base of the mandibles, two short lines on the mesonotum, the scutellums, two large marks on the apex of the metanotum, the lower edge of the propleuræ all round, the lower half of the mesopleuræ, the apex of the petiole, a large mark on the sides of the second and third segments at the apex, and the apices of all the segments, pale yellow. The four front legs pale yellow, the femora rufous above, the middle more distinctly so than the anterior; the tarsi blackish, the hinder coxæ yellow above (except narrowly at the apex), the basal half rufous below, the apical black; the hinder femora rufous, the tibiæ pale yellowish testaceous, with the apical third black; the hind tarsi black. Wings hyaline, the stigma testaceous, the nervures darker. Abdomen twice the length of the thorax. ♀.

Face sparsely punctured and covered with short white hair; in the centre is a triangular black mark, which (below) is continued along the top of the clypeus; the middle of the vertex strongly transversely striated. Base of median segment closely and distinctly punctured; the areola about as long as wide, its sides at the base rounded, its apex transverse; inside it is distinctly and somewhat irregularly striated; the posterior median area is depressed on the basal half and irregularly rugose; the outer area coarsely obliquely striated. The hinder half of the propleuræ closely striated; the mesopleuræ closely punctured; the metapleuræ still more strongly punctured and more thickly covered with pale pubescence.

*Caspipina violaceipennis*, sp. n.

Ferruginous; the abdomen black (except the postpetiole, the apical two thirds of the second segment, and the sides of



the third); the inner orbits broadly, the outer more narrowly, and the base of the mandibles, yellow. Legs coloured like the body, the four front coxæ with a yellowish tinge. Wings fuscous violaceous; the stigma and nervures black; the areolet triangular, the nervures almost touching above. ♀.

Length 17–18 mm.

*Hab.* Khasia. Coll. Rothney.

Face and clypeus closely punctured, the clypeus thickly covered with white pubescence, the face with a shorter and sparser pile. Tips of mandibles black. Palpi pale rufous. The edges of the mesonotum, the parts at the sides of the scutellums, the base and apex of the metanotum, the apical keels, the middle of the propleuræ, the upper part, base, and apex of the mesopleuræ, and the base and lower part of the metapleuræ, black. Mesonotum closely and minutely punctured; the scutellum not quite so closely punctured. Median segment closely and rather strongly punctured; the areola longer than broad; its sides bulge roundly outwardly; the apical slope is irregularly transversely striated. Propleuræ obscurely, the meso- and metapleuræ closely and distinctly, punctured.

Differs from *C. ferruginea* in the areola being limited behind by a keel, by the middle of the segment having at the base a distinct oblique slope, by the lateral keels on the top of the apical slope of the segment being quite straight and sharply oblique, not curved upwards; the face and pleuræ are more distinctly tinged with yellow and the abdominal segments are more broadly marked with black.

*Algathia parvimaculata*, sp. n.

Black; the sides of the face (broadest below), the clypeus (except at the apex narrowly), the mandibles (except at the apex), the palpi (except at the base), the inner orbits to the hinder ocelli, the base of the pronotum, the sides more narrowly, the base of the tegulæ broadly, the tubercles, the scutellums, the teeth on the median segment, the apex of the petiole, the sides of the second segment more narrowly, and the sides of the third in the middle, yellow. Legs red, the coxæ and trochanters black, the four anterior marked with yellow on the outer side, the fore trochanters yellow in front; the tibiæ have the red colour suffused with yellow; the hinder coxæ, trochanters (except at the apex), the apex of the femora, the apical half of the tibiæ, and the hinder

tarsi, black. Wings hyaline, the nervures and stigma black. ♂.

Length 9 mm.

*Hab.* Khasia. Coll. Rothney.

Antennæ as long as the body, the scape in the middle beneath and a band (three to four joints) in the middle, white; the scape covered with fuscous, the flagellum more thickly with short black hair. Face closely and uniformly punctured, as is also the mesonotum; the front and vertex closely punctured. Scutellum roundly raised and sparsely covered with long white hair. Base of median segment obliquely depressed in the middle, aciculated; the areola is square, rounded at the base, the basal keel indistinct; the posterior median area strongly, closely, and somewhat irregularly striated; the lateral closely and uniformly punctured; the spiracular finely punctured at the base, the rest more rugosely punctured, the apex transversely striated. Propleuræ strongly punctured, more strongly above than below; the centre with seven stout keels. Mesopleuræ closely punctured, in the centre obscurely striated. Metapleuræ punctured like the mesopleuræ. The second and third abdominal segments are closely punctured, the others are thickly covered with white hair; the gastrocæli smooth and shining on the flat central part; on the inner side of the base are three oblique keels.

#### ICHNEUMONINI (*Oxypygi*).

##### ULESTA, gen. nov.

Antennæ thickened and compressed beyond the middle. Head largely developed behind the eyes; the occiput margined. Clypeus not separated from the face, its apex transverse. Mandibles with a large acute apical tooth and a small blunt one at its base. Scutellum flat, its sides not keeled. Median segment not completely areolated; the areola fully three times longer than broad and slightly dilated in the middle. Areolet 5-angled; the transverse median nervure is received slightly in front of the basal. Legs short and stout; the hinder femora scarcely reaching to the middle of the third abdominal segment; the hinder tarsi spinose. Abdomen with seven segments; the apex of the petiole and the middle segments closely punctured; the ventral fold extends to the fourth segment.

The malar space is large, the eyes not reaching much below the middle of the face and extend to the top of the head; they are margined; the face flat. Scutellum only

slightly convex, not margined; the postscutellum bifoveate at the base. Spiracles linear. Petiole as in *Ichneumon*. Gastrocœli large, deep. The base of the median segment is not depressed. Wings short, hardly reaching to the apex of the third abdominal segment.

Characteristic are the short wings and antennæ.

*Ulesta varicornis*, sp. n.

Black; the median segment and the basal three segments of the abdomen rufo-ferruginous; the base of the pronotum and the scutellum yellow; the eighth to sixteenth joints of the antennæ white; the four front legs rufo-ferruginous; the apices of the coxæ, the trochanters, and the knees yellowish; the hinder coxæ, trochanters, and the extreme base of the femora reddish; the femora black, the hinder tibiæ black, with a broad rufous band above and at the middle; the tarsi blackish. Wings hyaline; the nervures and stigma pale fulvous. Mandibles rufous in the middle. Palpi pale testaceous. ♀.

Length 11 mm.

*Hab.* Khasia. Coll. Rothney.

Face closely punctured and thickly covered with short white hair; the clypeus punctured at the base and on the apical margin; the front and vertex are more closely and strongly punctured; the punctures on the front running into reticulations below. Pronotum closely and somewhat strongly punctured; the mesonotum very closely punctured and thickly covered with a pale fulvous down, the scutellum thickly with long fuscous hair and strongly punctured. Median segment at the base closely punctured, its apex closely, transversely, its sides more strongly, obliquely, striated; the spiracular area closely rugose behind the spiracles, in front of them strongly obliquely striated. Propleuræ above strongly punctured, the lower part with stout distinctly separated striations. Mesopleuræ above closely longitudinally striated, below closely punctured; they are covered with pale fulvous hair. Metapleuræ closely punctured, the apex obliquely striated. Apex of petiole laterally strongly punctured, the middle finely longitudinally striated, the second, third, and fourth segments closely punctured; the gastrocœli large, smooth, except for three stout keels on the base; the space between them is sharply longitudinally striated; the apical segments are thickly covered with white hair; the sheaths of the ovipositor black, thickly covered with white hair.

LVIII.—*On the Occurrence of Gobius capito, C. & V., in Cornwall.* By FREDERICK PICKARD-CAMBRIDGE, B.A., F.Z.S.

[Plate XXX.]

IT is now four years ago since Mr. G. A. Boulenger made the interesting discovery of this fine goby at Concarneau and in the Gulf of St. Malo (Ann. & Mag. Nat. Hist. ser. 7, vol. iv. p. 229, 1899), a species hitherto recorded only from the Mediterranean. It occurred to him at the time that it was quite possible that this fish might also be found on our side of the Channel, and his surmise was strengthened by the recollection that Couch, in his 'Fishes of the British Islands,' vol. ii. p. 153, had stated that he had seen gobies of 9 inches in length in the rock-pools on the coast of Cornwall, presumably near Polperro. These fish, however, this author had referred to *Gobius niger*, Linn., considering that their large size was due to their isolation in the deep pools lying above the ordinary neap-tides and to the abundance of food found in these places. Boulenger communicated his suspicions to Messrs. Holt and Byrne, of the Department of Agriculture and Technical Instruction for Ireland, who were engaged in a Report on the Sea and Inland Fisheries of Ireland, which was published early this year (1903), and contains an admirable monograph of the "Gobiidæ," including some excellent plates.

For some reason or other, however, the giant goby, *G. capito*, which Messrs. Holt and Byrne refer to in their monograph, had not, in spite of a great deal of laborious collecting and observation on the coast of Ireland and in Devonshire and Cornwall, surrendered itself to science until the August of this year, when I was myself fortunate enough to find them in abundance at Port Scatho, on the coast of Cornwall, between Falmouth and Fowey.

Mr. Boulenger had often begged me to look out for gobies on my sea-fishing expeditions and rambles along the coast, and especially urged me, just before visiting Cornwall, to see if possible what these large gobies might be. It is curious that no one else should have come across them previously, because those that Couch records were probably found at Polperro; and if so, they most likely occur all along that coast. Holt and Byrne distinctly point out that *G. niger* is an estuarine species, never found in rock-pools, and also that the extreme length attained by *G. paganellus*, the rock-pool



goby *par excellence*, is about 5 inches. The chances of finding a *paganellus* 9 inches long, or, perhaps, an unrecorded species, would have induced those interested, one would have supposed, to have made a definite raid on the rock-pools of Polperro.

It is quite possible, of course, that *G. capito* is very local, for where it occurs it is abundant, and when of large size a very conspicuous fish. Specimens of from 7 to 9 inches in length would dart away to their hiding-places directly one showed oneself over the fringing rocks around any of those deep pools whose position and character Couch has so well described. Certainly to the casual observer specimens of 4 or 5 inches would not at a glance be distinguished from *G. niger*; but the broader, more inflated head, darker colour (in preserved specimens), and different markings of these rock-pool gobies arrest attention at once.

The greater width between the eyes and the free lateral lobes on the anterior membrane of the ventral fin are not, however, so marked as in the larger adult specimens. It is strange also, and perhaps the fact lends colour to the possibility of the restricted localization of this species, that in these pools, and, indeed, in all the tidal pools along the coast, not a single specimen of *G. paganellus* was taken.

Perhaps the pools are not large enough for both species to exist together in amity, possibly *G. capito* will not tolerate neighbours of another colour in his special pools; and if so, one can well understand that poor *paganellus* would go to the wall, or, more probably, down his cousin's throat, for *capito* is very strong, much larger, and with a healthy appetite.

In a single large pool on the upper rocks, reached only by the spring-tides, there must have been twenty or thirty of the giant goby. Like all the gobies, they are very voracious, dashing out and seizing anything that appears to them eatable, retiring to their dens to discuss the morsel at leisure. Otherwise they are exceedingly shy, and even a hand held up above the pool from behind the rocks against the sky-line will scare them to their deep retreats in one or other far corner of the pool. These holes are often a couple of feet deep, and at a time of general alarm become half-filled with gobies of all sizes which rush to them for shelter.

As soon as everything has quieted down, one by one the smaller fish sally forth again, but it is only with very great caution that the larger and more experienced will adventure themselves outside. First the snout, then very slowly the broad flat head and watchful eyes appear at the entrance of

the hole, and gradually the great grey goby slides down into deep water, resting motionless at the bottom and almost lost to sight, so well do the mottled tints assimilate with the rocks and stones at the bottom of the pool.

The ventral fin has all the appearance of a sucker, but observations tend to the conclusion that it has no adhesive power, but is merely tactile in its function. The fish are excellent eating by all accounts, and when of large size are worth the trouble of cooking.

A detailed description of this giant goby is given below, with a few notes on the other two more nearly allied species, with a key to their differential characters.

*Key to the Species referred to in this paper.*

- A. Size of adults larger, reaching from 7-9 inches long. Lateral margin of anterior membrane of ventral fin free, forming either a pointed (immature) or rounded (adult) lobe. Interorbital space only slightly less than the transverse diameter of the eye ..... *G. capito*, C. & V.
- B. Size of adults smaller, never longer than 5 inches. Lateral margin of anterior membrane of ventral fin not free. Interorbital space scarcely wider than one fourth the transverse diameter of the eye.
  - a. First dorsal with a yellow or orange marginal band. Scales smaller, not less than 50 in longitudinal series on the lateral line. Median rays of first dorsal not prolonged. Filiform rays on upper margin of pectorals more numerous, 12 ..... *G. paganellus*, Linn.
  - b. First dorsal without marginal band. Scales larger, not more than 42 in longitudinal series. Median rays of first dorsal prolonged. Filiform rays of pectorals less numerous, 4 or 5 ..... *G. niger*, Linn.

*Gobius capito*, Cuv. & Val. (Pl. XXX. figs. a, b, & c.)  
(Giant or Big-headed Goby.)

- 1836. *Gobius capito*, Cuv. & Val. Hist. Nat. Poissons, t. xii. p. 21.
- 1836. *Gobius limbatus*, Cuv. & Val. loc. cit. p. 345, fig. 345 (sec. Steindachner).
- 1840. *Gobius exanthematosus*, Nordm. in Demid. Voy. Russ. Mérid. iii. p. 423, Poiss. pl. x. fig. 1.
- 1863. *Gobius niger*, Couch, Fishes of the British Islands, vol. ii. p. 153, figure.
- 1861. *Gobius capito*, Günther, loc. cit. vol. iii. p. 55.
- 1881. *Gobius capito*, Moreau, Hist. Nat. Poissons de France, t. ii. p. 203, fig. 102.

1899. *Gobius capito*, Boulenger, Ann. & Mag. Nat. Hist. ser. 7, iv. p. 229.

1899. *Gobius capito*, Holt, Ann. Mus. Marseille, v. p. 43.

1903. *Gobius capito*, Holt & Byrne, Rep. Sea and Inland Fisheries of Ireland for 1901, pt. ii. p. 46.

Of this grand species Cuvier and Valenciennes say:—"La membrane antérieure de sa ventrale, qui est fort épaisse, a de chaque côté un lobe arrondi, ce qui la rend comme trilobée." And this, indeed, is the character which infallibly distinguishes it from either *G. niger* or *G. paganellus* in examples of the same size, though when adult *G. capito* is twice as large as either of these species. In immature examples, however, the lobe is not rounded, but sharp.

### Description.

*Dimensions*.—The adult male reaches the length of from 9 to 10 inches. Twenty examples from the same pool varied from 7 to 2¼ inches. The head very broad, with cheeks dilate, is rather less than one fourth the total length, is slightly longer than broad, and is slightly broader than deep. The dorsal fin at its base is exactly one half the length of body exclusive of the caudal fin. The pectoral fin is as long as the head is broad; the ventral fin is as long as the first dorsal is at its base and exactly the length of the anal fin. The interorbital space in adult examples is rather less than the diameter of the eye, but is much narrower in proportion as the examples diminish in size. The caudal peduncle is in width about one tenth the total length.

*Scales*.—The total number in longitudinal series from the base of the pectoral fin to the caudal fin along the median lateral line is from 65–68, always more than 60; in transverse series from the base of the posterior ray of the second dorsal fin to the posterior ray of the anal from 15–16 scales. The squamation of the head ceases at a line drawn tangential to the posterior margins of the eyes, and the upper part of the operculum is slightly squamose. The first dorsal fin has 6 rays, the medians not noticeably longer than the rest; the second dorsal has 15 rays; the caudal is rounded, nearly circular when fully spread. The anal fin has 12 rays. The first 10 or 12 rays of the upper margin of the pectorals are filiform. The ventral fin is nearly circular, the anterior membrane being detached at its posterior margin, forming on each side a blunt rounded lobe in the adult and a sharply pointed lobe in the immature.

*Coloration*.—Very variable in different individuals, ranging from pale orange-pink or sandy to sooty black. Freshly

caught examples are beautifully mottled with various markings of different shades of grey, thus closely assimilating with the rocks and gravel of the pools which they frequent.

In preserved examples the beautiful gradations of colour vanish and the markings become more distinctly differentiated.

All the fins except the ventral are pale, with more or less irregular rows of transverse, chevron-like, sooty-black blotches. The caudal fin has four or five irregular transverse bars of chevron-like sooty-black blotches; in the anal fin the blotches are very pale. The ventral fin is pale in some examples, more sooty in others, when it is seen to be minutely speckled with black. Pectoral fins with a dark basal suffusion and transverse bands, more or less regular, of chevron-like dark blotches.

The head is dark sooty black above, the cheeks and operculum being richly blotched with black. The dorsal area is deeply suffused with black blotches, which extend irregularly down the sides and across the lateral line, terminating along the belly in a row of distinct irregular blotches from the pectoral fin to the tail. The central lateral area of the caudal peduncle is marked with three elongate, wedge-shaped, black blotches. Ventral area sometimes pale, often sooty, when it becomes minutely speckled with black.

This species may be distinguished from *G. niger*, (1) by the free lateral lobe on the anterior membrane of the ventral fin, (2) by the smaller size of the scales, (3) by the greater width between the eyes, and (4) by the median rays of the first dorsal not being prolonged; from *G. paganellus*, (1) by the absence of the yellow band on the margin of the first dorsal, (2) by the lateral free lobe of the ventral fin, and (3) by the more numerous scales in longitudinal and transverse series.

The following represent the measurements of four examples of this species:—

	B.	Tot.	H.	Sn.	E.	Io.	Dp.	Cp.	Fin-rays.				Scales.	
									1st D.	4th Ray.	2nd D.	An.	Long.	Trans.
♂. 1.	150	188	45	15	8	7	37	19	VI	21	15	12	65	15
„ 2.	153	195	48	15.5	9	7	38	24	VI	23	15	12	68	15
♀. 3.	125	150	38	13	7	6	28	17	VI	17	15	12	65	15
„ 4.	88	101	27	9	4.5	3	20	11	VI	13	15	12	66	15



*Gobius paganellus*, Linn.  
(Rock-Goby.)

1758. *Gobius paganellus*, Linn. Syst. Nat. ed. x. t. i. p. 263.  
 1836. *Gobius paganellus*, Cuv. & Val. Hist. Nat. Poiss. t. xii. p. 22 (sec. Moreau).  
 1839. *Gobius niger*, Thompson, Ann. & Mag. Nat. Hist. vol. ii. p. 417 (sec. Günther).  
 1863. *Gobius paganellus*, Couch, Fishes of the British Islands, ii. p. 157, fig. 99.  
 1880. *Gobius paganellus*, Day, Fishes of Great Brit. and Irel. i. p. 162, pl. lii. fig. 2.  
 1881. *Gobius paganellus*, Moreau, Hist. Nat. Poissons de France, ii. p. 225.  
 1897. *Gobius paganellus*, Beekford, Proc. Dors. Nat. Hist. Field-Club, xviii. p. 27.  
 1898. *Gobius paganellus*, Holt & Byrne, Journ. Mar. Biol. Assoc. v. p. 335.  
 1903. *Gobius paganellus*, Holt & Byrne, Rep. Sea and Inl. Fisheries of Ireland, p. 45, pl. i. figs. 1 (♀), 2 (♂).

It is fairly evident from Linnæus's diagnosis that the species attributed to this name by Cuvier and Valenciennes is in all probability that which the older author characterized, for he says: "lutea transversa in summo pinnæ dorsalis primæ." Cuvier remarks: "le bord de la nageoire porte toujours une large bande d'un jaune citron." This, indeed, is the best character by which the species may be distinguished at a glance from *G. niger* or *G. capito*.

Holt and Byrne give a detailed description, but the following characters may be pointed out. It may be distinguished from *G. niger*, (1) by the yellow or orange upper marginal band on the first dorsal, (2) by the smaller size of the scales, not less than fifty in longitudinal series, (3) by the normal length of the median rays in the first dorsal, and (4) by the greater number of the filiform rays on the upper anterior margins of the pectorals; from *G. capito* it may be recognized, (1) by the yellow marginal band on the first dorsal, (2) by the slightly larger scales, about 68 in *G. capito*, longitudinal series, (3) by the anterior membrane of the ventral fin being united throughout, (4) by the less proportional width of the interorbital space, and (5) by the adult being limited to  $4\frac{3}{4}$  inches total length.

Holt and Byrne regard this species as entirely confined to rock-pools between the tides; not, like *G. niger*, an estuarine species. It occurs from the north of Ireland and Scotland to the south coast of England.

The following measurements represent those of a male of rather less than full size:—

	B.	Tot.	H.	Sn.	E.	Io.	Dp.	Cp.	Fin-rays.				Scales.	
									1st D.	4th Ray.	2nd D.	An.	Long.	Trans.
♂.	87	105	26.5	7	6.5	1.75	19	12	VI	11	15	13	56	12

*Gobius niger*, Linn.

(Black Goby.)

1758. *Gobius niger*, Linn. Syst. Nat. ed. x. t. i. p. 362.

1836. *Gobius niger*, Yarrell, British Fishes, vol. i. p. 251 (ad partem).

1836. *Gobius britannicus*, Thompson, P. Z. S. p. 61.

1863. *Gobius niger*, Couch, Fishes of the British Islands, vol. ii. p. 153 (ad partem).

1880. *Gobius niger*, Day, Fishes of Gt. Brit. and Irel. vol. i. p. 163, pl. lii. fig. 3.

1881. *Gobius niger*, Moreau, Hist. Nat. Poiss. de France, ii. p. 230.

1891. *Gobius niger*, Petersen, Fiskeri-Beretning Kbhn. p. 244, pl. v. fig. 5.

1893. *Gobius niger*, Smitt, Scandinavian Fishes, pt. 1, p. 245, pl. xii. figs. 3-5.

1897. *Gobius niger*, Beckford, Proc. Dors. Nat. Hist. Field-Club, xviii. p. 27.

1903. *Gobius niger*, Holt & Byrne, Report of Sea and Inland Fisheries of Ireland for 1901, p. 43, fig. 1.

It is not possible to tell from Linnæus's diagnosis alone exactly to which species he gave the name *niger*, for he merely says: "pinna dorsi secunda radiis quatuordecim." The question has, however, been already settled, so far as it can be, by the Scandinavian authors, whose identification we must accept.

There is no reasonable doubt that the gobies usually identified as *G. niger* by modern English authors are identical with those described under that name by Petersen and Smitt, and the species has been so thoroughly described by Holt and Byrne, in their admirable monograph of the gobies of Great Britain and Ireland, that further description seems unnecessary.

One might, however, mention a few of the characters in which this species differs and may be recognized from either *G. paganellus* or *G. capito*.

Total length of full-grown examples 5 inches. Boulenger (Ann. & Mag. Nat. Hist. 1899, ser. 7, vol. iv. p. 229) quotes Mr. Allen of Plymouth to this effect. Holt and Byrne (*loc. cit.*) also give "about 5 inches" as the usual adult length, and I have before me examples of the male from Poole Harbour, Dorset, which also reach 5 inches.

The males of the gobies are to be recognized by the urogenital papilla being more attenuate and terminating in a point, whereas in the female it is broader and truncate or excavo-truncate at the apex. In the former sex of the present species also the third, fourth, and fifth rays of the first dorsal fin are usually prolonged, the fourth being, in one male from Poole, an inch and a quarter in length. They vary, however, with individuals, while the rays are only slightly prolonged and filiform in the female sex.

In *G. paganellus* the rays are not prolonged in either sex.

The scales are much larger in *G. niger* in proportion to its size than in either *G. paganellus* or *G. capito*, there being never more than forty, counting longitudinally from the base of the pectoral fin, along the lateral line, to the caudal fin. In a transverse line, counting obliquely forwards from the posterior ray of the second dorsal to the posterior ray of the anal, there are not more than nine scales, while in a 5-inch example a scale removed from the median line at this spot measured 3.75 millim. across. In the other two species a scale from an example of the same length measures about 2 millim. across; while there are not less than fifty scales in longitudinal series in *G. paganellus* nor less than sixty in *G. capito*.

The ventral fin resembles that of *G. paganellus* in having the anterior membrane united along its lateral margins, not free and bluntly pointed as in *G. capito*.

The first dorsal fin has no pale orange or yellow marginal band, as has *G. paganellus*.

The interorbital space is scarcely more in width than one fourth the transverse diameter of the eye.

So that *G. niger* may be distinguished from the latter species in both sexes by (1) the absence of any marginal orange band on the first dorsal fin, (2) by the larger size of the scales, and (3), in the male sex and to some extent the female, by the prolonged middle rays of the first dorsal fin.

It may be recognized from *G. capito*, in all ages of the latter, (1) by the anterior membrane of the ventral fin being united throughout its margin, (2) by the larger size of its scales, (3) by the less proportional width of the interorbital space, (4) by the prolongation of the median rays of the first dorsal, and (5) by the smaller adult size.

The following measurements of eight examples from Poole Harbour, Dorset, taken in October, will confirm the above characterization of the species:—

	B.	Tot.	H.	Sn.	E.	Io.	Dp.	Cp.	Fin-rays.				Scales.	
									1st D.	4th Ray.	2nd D.	An.	Long.	Trans.
♂. 1.	100	125	23	6	8	2	18	11	VI	23	13	12	37	8
„ 2.	95	115	19	4.5	7	2	18	11	VI	32	13	12	38	8
„ 3.	95	115	19	4.5	7	2	18	11	VI	19	13	12	37	8
„ 4.	77	92	18	4	5.5	1.5	14	8	VI	16.5	14	11	38	8
♀. 5.	90	112	17.5	4	7	2	18	10	VI	14	14	12	39	8
„ 6.	82	100	16	3.5	5.5	1.5	16	8.5	VI	13	14	11	36	9
„ 7.	79	98	15	3	5	1.5	16	8.5	VI	13	14	12	39	9
„ 8.	79	98	15	3	5	1.5	16	8.5	VI	13	14	12	39	9

B. Body. Tot. Total length. H. Head. Sn. Snout. E. Eye. Io. Interorbital space. Dp. Depth. Cp. Caudal peduncle. 1st D. First Dorsal. 4th Ray. 2nd D. Second Dorsal. An. Anal. Long. Longitudinal series. Trans. Transverse series.

#### EXPLANATION OF PLATE XXX.

Fig. a. *Gobius capito*, profile view (female).

Fig. b. Ditto, from above.

Fig. c. Ventral fin of ditto.

#### LIX.—On a new Species of *Helictis*.

By J. LEWIS BONHOTE, M.A.

HAVING recently had occasion to go over the genus *Helictis*, I find that the form found in Cochin China differs from those hitherto described, and therefore requires naming.

I propose to call it

*Helictis Pierrei*, sp. n.

General colour above brownish clay (“mummy-brown” of Ridgw.), each hair having a whitish glistening tip, more conspicuous in some examples than in others. These light tips reach their maximum development in the tail, and so predominate over the terminal two thirds of its length as to



entirely conceal the darker colour. Underparts dirty yellowish white. Markings on the face as in the other species, the white longitudinal line reaching to about the middle of the back.

The skull is slightly larger than that of true *personata* and the auditory bullæ considerably larger, especially when measured in the direction of the long axis of the skull. In other points, however, the skulls are similar.

*Dimensions* (of type from skin) :—

Head and body 400 millim.; tail 175; hind foot 60; ear 24.

Skull (see below).

*Habitat.* Saigon, Lower Cochin China.

*Type.* B.M. 78. 6. 17. 7. Adult male collected by M. Pierre in March 1867.

Outwardly this species, which is closely allied to *H. personata*, may be recognized by its slightly larger size and more rufous coloration. The difference in the bullæ of the skulls forms a well-marked and easily discernible character.

*Skull-measurements of H. personata and H. Pierrei compared.*

	Greatest length.	Basal length.	Palatal length.	Zygomatic breadth.	Greatest breadth of brain-case.	Length of auditory bullæ.	Width of basi-occipital at anterior end.
<i>H. Pierrei</i> , ♂, type . .	88	76	40	50	32	19	8·5
<i>H. personata</i> , ♂, Siam.	80	70	37	46	30	17	7·5

This genus can be subdivided into two well-marked groups, the difference lying in the size of the teeth, especially of the carnassial; the large-toothed group are the western forms, and consist of

*H. personata* (Is. Geoff.), from Pegu.

*H. nepalensis* (Hodgs.), from Nepal.

*H. orientalis* \* (Horsf.), from Java.

*H. Pierrei*, described above.

Of the small-toothed group we have

*H. moschata*, Gray, from China.

*H. subaurantiaca*, Swinhoe, from Formosa.

*H. Everetti*, Thos., from Borneo.

*H. subaurantiaca* is very closely allied to the mainland

\* *Melogale fusca*, Guérin, Mag. Zool. 1835, pl. xvi., is a synonym of this species.

form, from which it differs chiefly in the yellowish colour of the underparts.

*H. Everetti* is a small form of *H. orientalis*, but is markedly distinct, owing to the teeth-differences.

*H. nepalensis* much resembles *H. orientalis*, differing from it in being slightly larger. It is practically identical in size with *H. personata*.

The white tips to the hairs, although a conspicuous feature, are, owing to their variability, useless as a specific character. They are most noticeable in true *personata*, and, as a rule, entirely absent in *nepalensis*, *orientalis*, and *Everetti*; in the Chinese species, although present, they are of such a tint as to be hardly discernible.

LX.—*Description of a new West-African Fish of the Genus Alestes.* By G. A. BOULENGER, F.R.S.

*Alestes brevis.*

Depth of body  $2\frac{3}{4}$  to 3 times in total length, length of head  $3\frac{3}{4}$  to  $4\frac{1}{4}$  times. Head  $1\frac{2}{3}$  to  $1\frac{3}{4}$  as long as broad,  $1\frac{1}{6}$  to  $1\frac{1}{3}$  as long as deep; the distance between end of snout and occiput not or but slightly exceeding width of head; snout rounded, scarcely projecting beyond the lower jaw, 1 to  $1\frac{1}{2}$  as long as eye; eye lateral, visible from above and from below, its diameter  $\frac{3}{4}$  to  $4\frac{1}{3}$  times in length of head; adipose eyelid scarcely developed; interorbital width  $\frac{1}{2}$  length of head; maxillary not reaching to below anterior border of eye; 18 or 20 teeth ( $\frac{10-12}{8}$ ) in the upper jaw; lower border of second suborbital as long as or longer than diameter of eye. Gill-rakers rather short and thin, 18 to 20 on lower part of anterior arch. Dorsal II 8, above middle of space between ventrals and anal, considerably nearer caudal than occiput; first branched ray longest,  $\frac{3}{4}$  to  $\frac{4}{5}$  length of head. Adipose fin short, twice or twice and a half as far from rayed dorsal as from caudal. Anal III 13–15, pointed in front, third simple ray longest,  $\frac{2}{3}$  to  $\frac{3}{4}$  length of head. Pectoral nearly as long as head, reaching or nearly reaching ventral. Latter shorter. Caudal deeply forked. Caudal peduncle not or but slightly longer than deep. Scales with numerous anastomosing

canals, 21-23  $\frac{4\frac{1}{2}}{2\frac{1}{2}}$ , 1 or  $1\frac{1}{2}$  between lateral line and root of ventral. Uniform brownish above, silvery white below.

Total length 105 to 225 millim.

One specimen from Lagos (*H. T. Ussher*) and four from the Gold Coast (*R. B. N. Walker*). These specimens have been referred to *A. macrolepidotus* by Dr. Günther. Steindachner's *A. macrolepidotus* from Liberia (Notes Leyd. Mus. xvi. 1894, p. 63) probably belongs to the same species.

The four closely allied *Alestes*, characterized by very large scales and the very posterior position of the dorsal fin, may be distinguished as follows :—

A. The distance between the end of the snout and the occiput much greater than the width of the head; snout projecting considerably beyond the lower jaw in the adult.

Anal 15-17; lat. l. 22-26; depth of body

$3\frac{1}{3}$  to  $4\frac{1}{3}$  times in total length ..... *A. macrolepidotus*, C. & V.

B. The distance between the end of the snout and the occiput not or but little greater than the width of the head; snout projecting but slightly beyond the lower jaw.

Anal 13-14; lat. l. 24-27; depth of body  $3\frac{1}{3}$

to  $3\frac{2}{3}$  times in total length ..... *A. grandisquamis*, Blgr.

Anal 16-18; lat. l. 21-23; depth of body  $2\frac{3}{4}$

to 3 times in total length ..... *A. brevis*, Blgr.

Anal 15-16; lat. l. 28-29; depth of body  $3\frac{1}{2}$

to 4 times in total length ..... *A. Batesii*, Blgr.

LXI.—*Descriptions of Thirty-one Terrestrial and Fluvial Mollusca from South Africa.* By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S.

[Plates XXXI. & XXXII.]

AFTER an interval of more than two years\* we are enabled to offer another contribution (the seventeenth) towards the elucidation of the non-marine Molluscan fauna of South Africa, in which are included descriptions of several species of *Ennea* and *Trachycystis*—*T. scolopendra*, perhaps, being the most remarkable Helicoid yet reported from this region. An *Achatina*, *Buliminus*, *Planorbis*, a most interesting *Fauxulus*, a *Tropidophora*, and a *Chondrocyclus* are, amongst

\* Ann. & Mag. Nat. Hist. ser. 7 (Oct. 1901), vol. viii. pp. 315 sqq.

others, likewise differentiated, their discovery being mainly due to the continued indefatigable researches of Messrs. J. Crawford, J. Farquhar, and H. Burnup.

We also take the opportunity of refiguring *Hypolysia Florentiae*, M. & P. (Pl. XXXII. fig. 13), the original drawing \* not sufficiently exhibiting the salient peculiarities of the peristome.

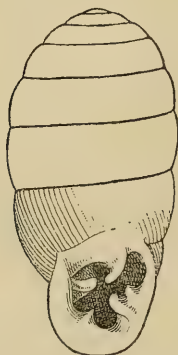
*Ennea calopasa* †, sp. n.

*E. testa rimata, recte cylindrica, albida, pulchre subpellucente; anfractibus novem, apice obtusissimo, fere applanato, cæteris apud suturas impressis, undique longitudinaliter arcte liris, liris obliquis; apertura ovato-oblonga, intus alba, peristomate albo, nitido, incrassato, plicis dentibusve quinque munito: plica parietali nitida, acinaciformi, intrante, dentibus duobus labialibus acutis, superno majore, eadem basi congemminatis, dente basali parvo acuto, plica columellari conspicua, interne basin versus circumtorquente.*

Long. 14, lat. 6 mm.

*Hab.* Port Shepstone, Natal (*Burnup*).

This very beautiful form, Mr. H. Burnup writes, has so far only occurred in small quantity, say in the proportion of



*Ennea Albersi.*



*Ennea calopasa.*

one to ten, as compared with the larger *E. Albersi*, Pfr., from the same locality. He has favoured us with the following comparative note, accompanied by two most accurately drawn figures:—

\* *Loc. cit.* pl. ii. fig. 8.

† *καλός πᾶς*, altogether beautiful.



*E. Albersi*, Pfr.*E. calopasa*, sp. n.

(a) Labial teeth.

Two: upper smaller, lower  
arising nearer the peristome.Two: lower smaller, upper arising  
nearer the peristome.

(b) Columellar plaits.

With straight, club-shaped rib,  
nearly horizontal, or sloping slightly  
downwards.With curved rib, beginning with  
a sharp downward turn, and curving  
round the base of the columellar  
plait.

In addition to the above-mentioned distinctions, the form should be noticed, the contour being much straighter and the whorls far less ventricose in the smaller species, *calopasa*.

It should also be remarked that the longitudinal liræ are far more oblique around the upper than on the last two whorls.

*Ennea claustraria* \*, sp. n. (Pl. XXXI. fig. 16.)

*E. testa* ovato-cylindrica, ad basin subrimata, lævissima, polita, pallide corneo-hyalina, delicata; anfractibus 8, apice obtusissimo, cæteris uniformibus, ultimo brevi; apertura lunari; peristomate albo, nitido, incrassato, serie multiplici dentium plicarumque prædito: plica parietali oblonga, obtusa, plica, potius quam dente, labiali triplici, intus V formante, dente basali remoto, sulcato, mammæformi, plica columellari interna, maxima, aperturam fere claudente.

Long. 7, lat. 3 mm.

*Hab.* Lower Umfolosi Drift, Zululand (*Burnup*).

An *Ennea* with most remarkable peristomatal processes, allied to *E. dædalea*, described in this paper, and even more intricately multiplex in its arrangement of teeth and plaits. Indeed, the large sulcate mammæform internal columellar plait very nearly closes up the aperture.

*Ennea craterodon* †, sp. n. (Pl. XXXI. fig. 9.)

*E. testa* cylindrica, oblonga, breviter rimata, solidula; anfractibus 9-10, apice valde obtuso, cæteris fere rectis, apud suturas impressis, undique longitudinaliter arcte striatis, striis obliquissimis; apertura angusta, ovato-triangulari; peristomate apud basin producto, dentibus plicisve quatuor prædito: plica parietali magna, recta, haud multum intrante, dente labiali bifido, inferiore præstante; columella undique incrassata, plica columellari interna, mamillata.

Long. 9, lat. 3 mm.

\* *Claustrarius*, protected by a claustrum or barrier.† *κραιπερόδων*, strong-toothed.

*Hab.* Maeström Forest, Bedford (*Farquhar*).

With the form of *E. Leppani*, Stur., the arrangement of plaits in *E. craterodon* is quite different, the labial tooth being also more developed. A basal process is also present. *E. Arnoldi*, Stur., is like in form of peristome, but the whorls in that species are far more tumid and it is also smaller in every detail.

*Ennea daedalea*, sp. n. (Pl. XXXI. fig. 12.)

*E. testa* cylindrica, subrimata, polita, albo-lactea, hyalina, tenui; anfractibus 7-8, apice obtuso, planato-depresso, cæteris tumidulis, nitidissimis, perlævibus; apertura subcirculari; peristomate multum incrassato, nitido, plicis dentibusve magnopere complicato: plica parietali oblonga, labiali trifurcata, incurva, multum intrante, dente basali brevi, intus duplicato, plica columellari apud medium profunde sulcata, intus extensa, margine columellari perincrassato.

Long. 8, lat. 3.50 mm.

*Hab.* Lower Umfolosi Drift, Zululand (*Burnup*).

A species with remarkably elaborate mouth-processes, almost closing the roundish aperture, and suggesting the specific title proposed. These processes consist of:—(i.) a simple, oblong, internal, parietal plait; (ii.) a multiplex labial, thrice-divided and curving inwards; (iii.) a small, simple, basal tooth; and (iv.) a columellar plait, wholly internal, large, and subdivided centrally by a deepish furrow. The surface is white and polished, with the slightest sign of longitudinal striation at the extreme base only. It is a very distinct form.

*Ennea genialis*, sp. n. (Pl. XXXI. fig. 14.)

*E. testa* cylindrica, subrimata, pellucida, albo-vitrea, apice obtusissimo; anfractibus 9, apud suturas multum impressis, tumidulis, undique longitudinaliter arcuè liris, liris superne obliquis, apud anfractum penultimum fere, apud ultimum omnino, rectis; apertura orbiculari; peristomate albo, nitido, incrassato, plicis dentibusve quatuor munito: plica parietali bifida, multum intrante, labiali furcata, incurva, dente basali parvo, simplici, plica columellari omnino interna, magna, mammæformi, margine columellari incrassato.

Long. 5, lat. 2 mm.

*Hab.* Patana, Zululand (*Burnup*).

The chief peculiarities of this very refined little *Ennea* appear to consist in the bifid parietal and curious scimitar-like, incurved, and duplicated labial plait; the longitudinal

liræ are also to be noted, being very oblique on the upper whorls, and gradually merging into straightness over the body-whorl.

It is to some extent comparable with *E. differens*, Sturany. A few examples.

*Ennea himerothales* \*, sp. n. (Pl. XXXI. fig. 13.)

*E. testa* rimata, breviter cylindriciformi, nitida, fere lævi, delicata, subpellucida; anfractibus 7, apicalibus obtusissimis, cæteris inflatis, supernis angustis, penultimo latiore, apud suturas sub lente utrinque oblique striatis, striis in medio evanidis, ultimo anfractu lævissimo; apertura anguste trigonali; peristomate albo, nitido, dentibus plicisve sex instructo: plica parietali lata, haud intrante, truncatula, dente labiali bifurcato, parte superiore minore, dente basali inconspicuo, parvo, dente columellari calloso, incrassato, subtus plica interna grandi, mamillata, prædito.

Long. 4, lat. 2 mm.

*Hab.* Port Shepstone, Natal (*Burnup*).

A shining nearly transparent little *Ennea*, shortly cylindrical in form, and smooth, excepting just round the sutures of the upper whorls, where, with a lens, slight oblique striation is discernible, the body-whorl being quite smooth. The peristomatal processes are six in number—a truncate parietal plait, two labial bifurcate teeth on a common base, a small basal tooth, a columellar one much thickened, and below this last a mamillate plait.

*Ennea montana*, sp. n. (Pl. XXXI. fig. 15.)

*E. testa* cylindrica, doliiformi, parva, subperforata, vitrea, vel incrassata; anfractibus 7, apicalibus obtusissimis, omnibus apud suturas multum impressis, in medio ad suturas utrinque oblique rudistriatis, striis apud medium anfractum evanidis; apertura trigona; peristomate centrali, albo, incrassato, dentibus plicisve quatuor munito: plica parietali conspicua, dente labiali bifido, parvo, subtus acuto, dente basali minore, plica columellari interna.

Long. 3·50, lat. 1·20 mm.

*Hab.* Mountain Drive, Grahamstown (*J. Farquhar*).

A very neat cylindrical species, the trigonous aperture placed more centrally in position than is the case in any other species we can recall.

*Ennea sylvia*, sp. n. (Pl. XXXI. fig. 4.)

*E. testa* minuta, recto-cylindrica, rimata, nitida, delicata, lævi, apice

\* *ἡμεροθάλης*, delightful.

obtusio; anfractibus 5-6, fere rectis; apertura subrotunda; peristomate albo, nitido, incrassato, plicis dentibusve quatuor munito: plica parietali dentiformi, parva, acuta, dente labiali bifido, acuto, basali et columellari minoribus, obtusatis, plica subtus columellam minime interna, mammæformi.

Long. 1·75, lat. ·75 mm.

*Hab.* Maeström Forest, Bedford (*J. Farquhar*).

An excessively minute smooth species of but few whorls, straightly cylindrical, and with the dental arrangement very prominently disposed upon the upper surface of the peristome. *E. Pentheri*, Sturany, appears much of the same magnitude and form, but the whorls in that species are more ventricose, and the peristomatal processes differ in the simple labial tooth, the basal being altogether absent.

*Ennea triglochis*\*, sp. n. (Pl. XXXI. fig. 11.)

*E. testa* cylindrica, rimata, paullum obesa, lævi, nitidissima, subhyalina, pallide straminea; anfractibus 8, quorum apicales  $1\frac{1}{2}$  globulares, perlæves, lubrici, cæteris tumidulis, sub lente arete et tenuissime leviter striatis, striis in speciminibus quibusdam apud basin fere evanidis, ultimo anfractu cæteros longitudine superante; apertura fere rotunda; peristomate nitido, crassiusculo; dentibus plicisve quatuor munito, tribus magis conspicuis: plica parietali acinaciformi, acuta, prominula, intrante, dente labiali parvo sed conspicuo, acuto, basali perparvo, plica columellari omnino interna, obtusa.

Long. 9·50, lat. 4 mm.

*Hab.* Botha's Hill, Maritzburg, Natal (*Burnup*).

A pale, straw-coloured, lubricous species, not unlike a *Pupina* superficially, and to which, judging from the figure, *E. sejuncta*, Stur., seems akin. It possesses the same character of oral teeth and plaits as do *E. cionis*, *juxtidentis*, M. & P., &c., but is much larger in every part. The labial tooth is acute, the basal often almost obsolete. It is a very distinct addition to the genus.

*Ennea virgo*, sp. n. (Pl. XXXI. fig. 10.)

*E. testa* mediocri, obeso-cylindriformi, hyalina, lævissima, polita; anfractibus  $8\frac{1}{2}$ -9, apice obtuso, cæteris minime ventricosulis; apertura lunari; peristomate tenui, albo, nitido, paullum incrassato, plicis dentibusve quatuor instructo: plica parietali acinaciformi, fere semicirculari, dente labiali simplici, acuto, incrassato, basali minore, inconspicuo, plica columellari interna, haud magna, omnino mammæformi.

Long. 11, lat. 4 mm.

\* *τρίγλωχis*, a thrice-pointed lance.



*Hab.* Lower Umfolosi Drift, Zululand (*Burnup*).

Glossy, white, and semitransparent, absolutely smooth throughout, with the peristomatal processes less developed than in the majority of its genus. The allies of this beautiful new form would seem to be *E. sejuncta*, Stur., from which it differs entirely in contour, while *E. Planti*, Pfr., and *Queketti*, M. & P., are both larger and possess slight longitudinal striation, of which there is no trace in *E. virgo*.

*Ennea Warrenii*, sp. n. (Pl. XXXI. fig. 7.)

*E. testa* rimata, cylindrica, albo-calcareo, apice obtuso-conico; anfractibus (apicali incluso) 8, tribus ultimis fere rectis, omnibus longitudinaliter obliquissime striatis; apertura rotunda; peristomate albo, nitido, incrassato, quatuor plicis dentibusve munito: plica parietali recta, acinaciformi, intrante, dente labiali bifurcato, acuto, superno minore, dente basali parvo, acuto, plica columellari omnino interna, mammæformi.

Long. 10, lat. 4.50 mm.

*Hab.* Lower Umfolosi Drift, Zululand (*Warren*).

A few examples of a conspicuous chalky-white form, with conspicuous lip, possessing four processes, as described above. The apex is obtusely conical, and the three lowest whorls are almost straight and uniform. Smaller in all its parts, but allied to *E. Albersi*, Pfr. At Mr. Burnup's request we name this interesting species after its discoverer, the Director of the Maritzburg Museum.

*Zonitoides Cupido*, sp. n. (Pl. XXXII. fig. 1.)

*Z. testa* depresso-conica, anguste umbilicata, delicata, hyalina, cornea; anfractibus  $5\frac{1}{2}$ , apice parvo, lævi, cæteris apud suturas haud profunde excavatis, ventricosulis, lævibus, nitidis, sub lente irregulariter longitudinaliter oblique striatulis; apertura effuse lunari, peristomate tenuissimo, columella ad marginem paulum reflexa.

Alt. 3.50, diam. 6 mm.

*Hab.* Lower Umfolosi Drift, Zululand (*Burnup*).

Of the same character as the North-American species *Z. arboreus*, Say, and its immediate allies, from all of which this very delicate, shining, and vitreous-horny species differs in its narrow umbilicus and slightly excavate whorls. It belongs to a group hitherto regarded as foreign to or adventitious in the South-African fauna, but we imagine will be ultimately shown to be really indigenous.

*Trachycystis centrifuga*, sp. n. (Pl. XXXII. fig. 9.)

*T.* testa conico-depressa, anguste umbilicata, tenuissima, hyalina, periostraco corneo, olivaceo-fusco omnino contexta; anfractibus 5, quorum duo apicales grandes, elevati, mamillati, cæteris ventricosulis, periostraco undique longitudinaliter oblique costellifero indutis, interstitiis spiraliter sub lente tenuistriatis, ultimo anfractu ad peripheriam acute carinato et regulariter fimbriato; apertura ovato-lunata, peristomate tenui, margine columellari supra umbilicum triangulatim reflexo, basi convexa.

Alt. 5, diam. 8.75 mm.

*Hab.* Maeström Forest (*Farquhar*).

Akin to *T. Planti*, Pfr., *T. actinotricha*, M. & P., &c., while differing from all in detail.

*Trachycystis glebaria*\*, sp. n. (Pl. XXXII. fig. 15.)

*T.* testa ovata, profunde sed anguste umbilicata, spira depressa, tenui, cornea, subpellucida; anfractibus 5, apice lævi, albescente, omnibus ad suturas impressis, ventricosis, longitudinaliter minutissime et arcte striatis, nitidiusculis; apertura lunata, peristomate tenui, marginem apud columellarem vix reflexo.

Alt. 2, diam. 3.50 mm.

*Hab.* Pinetown, Natal (*Burnup*).

A small but neatly formed species, with much depressed whorls, umbilicus narrow but deep, surface horny, seemingly smooth, but microscopically longitudinally striolate. Allied to *T. Glanvilleana*, Ancy.

*Trachycystis laticostata*, sp. n. (Pl. XXXII. fig. 5.)

*T.* testa parva, profunde umbilicata, depresso-conica, tenui, subhyalina, sed periostraco rudi, fuscato, omnino contexta; anfractibus 5, quorum  $1\frac{1}{2}$  apicales vitrei, læves, globulares, cæteris irregulariter et crasse laticostatis, costulis obliquis, rudibus; apertura fere rotunda, peristomate tenui, simplici.

Alt. 2, diam. 4 mm.

*Hab.* Maeström Forest, Bedford, Cape Colony (*Farquhar*).

Covered with a rough fuscous-black epidermis, and peculiarly rudely and broadly ribbed for so small a shell.

*Trachycystis oreina*†, sp. n. (Pl. XXXII. fig. 8.)

*T.* testa parva, conico-pyramidata, obtecte umbilicata, albo-cinerea, tenui, periostraco fusco-olivaceo, omnino contexta; anfractibus 5,

\* *Gleba*, a small clod of earth, from the resemblance.

† *ὄρεῖνος*, inhabiting heights.

apicali globulari, parvo, lævi, cæteris apud suturas impressis, paullum gradatis, undique longitudinaliter obliquistriatis, striis irregularibus, rudis; apertura lunata, peristomate tenui, margine columellari umbilicum triangulatim superimpendente.

Alt. 2·75, diam. 5 mm.

*Hab.* Mountain Drive, Grahamstown (*J. Farquhar*).

A plain species with dark brown epidermis and coarse irregular ribbing.

*Trachycystis patera*, sp. n. (Pl. XXXII. fig. 6.)

*T.* testa minuta, depressa, discoidali, perspective umbilicata, electrino-cornea, tenui; anfractibus 6-7, apicali minuto, lævi, cæteris arcissime sub lente longitudinaliter striatulis, striis fere rectis, apud suturas rotunde excavatis, ventricosulis; apertura depresso-lunata, peristomate tenui, simplici.

Alt. ·75, diam. 2·15 mm.

*Hab.* Maeström Forest, Bedford, Cape Colony (*J. Farquhar*).

Minute, but characteristic, and bearing a superficial resemblance in some points to the British *Gonyodiscus rotundatus*, Müll., than which it is much smaller, and very minutely and closely longitudinally striolate.

*Trachycystis permeata*, sp. n. (Pl. XXXII. fig. 2.)

*T.* testa profunde et sat late umbilicata, depressa, cinerea, tenui, epidermide omnino olivaceo-cornea contexta; anfractibus 5, quorum apicalis parvus, globularis, lævis, cæteris apud suturas rotunde excavatis, ventricosulis, undique arcte longitudinaliter obliquiliratis, liris inæqualibus, ultimo ad peripheriam obtuse carinato; apertura rotundo-lunari, peristomate tenui, margine columellari tenui, simplici.

Alt. 2·50, diam. 4·50 mm.

*Hab.* Pinetown, Natal (*Burnup*).

Conspicuous for its depressed contour, deep and fairly wide umbilicus, and roundly hollowed out sutures. We do not know any species quite comparable.

*Trachycystis scolopendra* \*, sp. n. (Pl. XXXII. fig. 3.)

*T.* testa depressa, paullulum conica, umbilicata, cinereo-fusca, hyalina, tenuissima, undique periostraco corneo induta; anfractibus 6, apicali minuto, mamillato, cæteris periostraco longitudinaliter irregulariter obliquilirato præditis, anfractu ultimo apud

\* *Scolopendra*, a centipede.

peripheriam liris brevibus, sed latis, pulcherrime expansis et frondosis induto, infra peripheriam ad basin convexo, et simili modo ac superne lirato; apertura rotundo-lunari, peristomate tenui, margine columellari paullum supra umbilicum reflexo.

Alt. 6, diam. 13 mm. (sp. min.).

„ 7.50, „ 15 „ (sp. maj.).

*Hab.* Port Shepstone, Natal (*Burnup*).

Five examples, a characteristic one being now figured; the largest of all that has been yet found is unfortunately imperfect, having the wonderful frondose extension of the epidermis worn away. These processes are thin, horny, hyaline, short but broad, and give a very striking and bizarre effect, rendering this one of the most strange and easily distinguishable of South-African Helicoids.

*Trachycystis simplex*, sp. n. (Pl. XXXII. fig. 7.)

*T.* testa ovato-conica, tenui, anguste sed profunde umbilicata, cinereo-olivacea, undique periostraco corneo, tenui, induta; anfractibus 5, apicali parvo, depresso, mamillato, cæteris undique arcte longitudinaliter obliquiliratis; apertura ovato-lunata, peristomate rotunde effuso, tenui, margine columellari supra paullum incrassato, umbilicum partim obtegente.

Alt. 6.20, diam. 9 mm.

*Hab.* Pondoland (*J. Farquhar*).

A simple species, thin, with horny epidermis or periostracum, very finely longitudinally lirate throughout. Akin to the typical series of the genus, e. g., *bisculpta*, Bens., and *Burnupi*, M. & P.

*Opeas McBeani*, sp. n. (Pl. XXXI. fig. 8.)

*O.* testa attenuata, fusiformi, delicata, subpellucida, pallide straminea; anfractibus 10, quorum duo apicales mammosi, cæteris apud suturas impressis, tumidulis, longitudinaliter undique minute obliquistriatis; apertura parva, labro tenui, margine columellari fere recto, crassiusculo, nitido, albo.

Long. 9.50, lat. 2 mm. (sp. max.).

*Hab.* Boksberg, Transvaal (*Burnup*).

Differing from its near ally *Subulina strigilis*, M. & P.\*, in its more globular apical whorls, finer striation, and smaller aperture. In that species, too, the last whorl is not so prolonged proportionately and the upper whorls are less ventricose than in this new form.

\* Ann. & Mag. Nat. Hist. ser. 7, vol. viii. p. 318.



*Buliminus (Pachnodus) Burnupi*, sp. n.  
(Pl. XXXI. fig. 5.)

*B.* testa oblongo-ovata, obtecte umbilicata, parum nitida, pallide gilva, fere lævi; anfractibus 7, apicali parvo, obtuso, cæteris longitudinaliter indistincte obliquistriatis, ultimo cæteros longitudine superante (9 mm.); apertura ovata, peristomate tenui, paullum effuso, columella recta, margine columellari albo, supra umbilicum leviter reflexo.

Long. 16, lat. 8 mm. (sp. min.).

„ 17, „ 9.50 „ (sp. maj.).

*Hab.* Lower Umfolosi Drift, Zululand (*Burnup*).

A distinctive form, which with much satisfaction we dedicate to its discoverer, whom we congratulate at the same time on the most promising results of his first explorations in a hitherto almost untried country.

*Fauxulus Crawfordianus*, sp. n. (Pl. XXXI. fig. 6.)

*F.* testa anguste rimata, cylindrico-fusiformi, lævi, subnitente, tenui, fusca; anfractibus 8-9, apicali mamillato, cæteris apud suturas impressis, fere lævibus, sub lente obliquissime longitudinaliter striatis, ultimo infra peripheriam abbreviato; apertura rotunda; peristomate albo, nitido, circumreflexo, continuo, sexplicato: plicis duabus parietalibus, acinaciformibus, una inferiore, acuta, intrante, duabus labialibus longe intrantibus, superiore obliqua, inferiore fere recta, dente basali subinterno, mammæformi, plica columellari acinaciformi, valde intrante.

Long. 8, lat. 3.75 mm.

*Hab.* Mossel Bay (*J. Crawford*).

A particularly fine and interesting dextral species of *Fauxulus* allied to *Pupa Layardi*, Bens. The peristomatal processes, six in number, are unusually complicated, as described in detail above. We have pleasure in connecting with it the name of Mr. J. Crawford, through whose kind instrumentality we have received so many new forms from South Africa.

*Achatina parthenia* \*, sp. n. (Pl. XXXII. fig. 10.)

*A.* testa oblonga, nitida, lævi, tenui, læte et pallide stramineo-olivacea, superne carneo-suffusa; anfractibus 8, quorum apicalis fere immersus, globularis, lævis, cæteris apud suturas impressis, gradatulis, ventricosis, quatuor supernis (apicali excluso) sub lente minutissime decussatulis, in antepenultimo fere evanidis,

\* *παρθενος*, a virgin.

duobus ultimis lævibus, nitidis; apertura ovata, peristomato tenui, paullum effuso, columella basin versus truncatula, tenui. Long. 38, lat. 19 mm.

*Hab.* Lower Umfolosi Drift, Zululand (*Burnup*).

Of the same group as *A. penestes*, M. & P., *transvaalensis*, Smith, and *Livingstonei*, M. & P., but very distinct from all, differing both in form and coloration from any described species. The shining stramineous hue, with a blend of olive, is peculiar; this is periostracal, the dead white of the shell itself showing through in occasional patches. The upper whorls with aid of a lens are seen to be most finely decussate; this gradually becomes evanescent, till the last two whorls appear quite smooth. Four examples, one immature.

*Isidora compta*, sp. n. (Pl. XXXII. fig. 14.)

*I.* testa ovato-oblonga, læte electrina, nitida, delicata; anfractibus 4, apicali diaphano, lævi, minuto, globulari, tribus supernis castaneis, omnibus tumidis, apud suturas impressis, ultimo rapide accrescente, sub lente artissime longitudinaliter tenuistriato; apertura ovata, peristomate paullum effuso, incrassato, marginato. Long. 14, lat. 6 mm.

*Hab.* Boksberg, Transvaal (*Burnup*).

A brightly coloured species, in which the longitudinal lines of growth are characteristic, opaque spaces alternating at intervals irregularly with subhyaline patches. It is more comparable with such Australian *Physæ* as *concinna*, Ad. & Angas, or *Grayi*, E. A. Sm., than with any of the well-known South-African forms.

*Physa zuluensis*, sp. n. (Pl. XXXII. fig. 4.)

*P.* testa rimata, rotundo-ovata, succineo-vitrea, delicatissima; anfractibus 5, supra abbreviatis, apice ipso albo-mamillato, cæteris ad suturas impressis, ultimo permagno, rapidissime accrescente, supra subsquarroso; apertura ovato-oblonga, peristomate tenuissimo, paullum apud basin prolongato, margine columellari crassiusculo.

Alt. 10, diam. 7 mm.

*Hab.* E. Zululand (*Burnup*).

*P. natalensis*, Krauss, seems the nearest ally to this species, the very extended and strongly shouldered body-whorl being characteristic.

*Ancylus (Ferrissia) gordonensis*, sp. n.  
(Pl. XXXI. fig. 2.)

*A.* testa ovata, cornea, tenui, apud marginem pallidiore, pellucida,

conica, apice antice prominulo, subacuto, sinistraliter inclinante, superficie, præcipue apud apicem, undique radiatim tenuissime striata, intus nitida, cornea, margine lacteo.

Alt. 3, long. 6, diam. 5 mm.

*Hab.* Gordon Falls, Natal.

This interesting addition to the South-African fauna differs from the two *Ancylus* hitherto described from this region, viz. *caffer*, Krauss, and *transvaalensis*, Craven, not only in form, but above all in the minute radiating striolations: the apex, inclining to the left, is placed well forward, the texture thin, and substance horny, pellucid. We have, towards the elucidation of this species, studied the elaborate paper of Mr. Bryant Walker on the Eastern North-American *Ancylus*\*, in which the genus is subdivided into two sections, viz.:—

(a) *Lævapex*.—Shell usually depressed, apex obtuse or subacute, smooth.

(b) *Ferrissia*.—Shell usually elevated, apex acute, radially striate.

It is therefore to the second of these subdivisions that this species, as also the next, belongs.

*Ancylus* (*Ferrissia*) *stenochorias* †, sp. n.

(Pl. XXXI. fig. 1.)

*A.* testa anguste oblonga, tenui, olivacea, conica, corneo-hyalina, intus omnino pallide cornea, nequaquam pallidi-marginata, apice antico prominulo, sinistraliter inclinante, obtuso, superficie radiatim obscure striatula.

Alt. 3, long. 8, diam. 4.50 mm. (spec. maj.).

*Hab.* Ebb en Vloed, Port Elizabeth.

The extreme narrowness of this little shell, we think, is of specific value. The radiating striæ are very obscure and only discernible with the aid of a lens. We have seen several examples, all precisely alike.

*Planorbis leucochilus* ‡, sp. n. (Pl. XXXI. fig. 3.)

*P.* testa parva, depressa, cornea, tenui, subhyalina, lævigata; anfractibus quatuor, tumidulis, suturis utrinque subimpressis, discis ambobus simillimis, paulum rotundatis; apertura depresso-lunata, peristomate tenui, albescente.

Alt. .70, diam. 2.50 mm.

*Hab.* Killarney Lake, Pietermaritzburg, Natal (*Burnup*).

\* 'Nautilus,' vol. xvii. no. 2, p. 13, and no. 3, pp. 25 sqq.

† στενοχώρια, narrowness of space.

‡ λευκός, χείλος, white-lipped.

Most akin to *P. Anderssoni*, Ancey, this little species may be distinguished by the conspicuous whiteness of its lip and aperture. We have seen about a dozen examples, all uniformly similar in every detail. The superficies is perfectly smooth, substance clear hyaline-corneous.

*Tropidophora comburens*, sp. n. (Pl. XXXII. fig. 12.)

*P. testa anguste umbilicata, conico-pyramidata, fere lævi, parum nitida, solidiuscula, stramineo-brunnea, et castaneo-suffusa; anfractibus 5, quorum duo apicales cinereo-lividi, læves, cæteris ventricosus, ad suturas angustissime livido-tinctis, ultimo rapide accrescente, lævi, spiraliter trizonato, zonis castaneis, quarum centrali maxime distincta, nigro-brunnescente, regione umbilicari spiraliter pulcherrime multilirata; apertura circulari, peristomate albo, nitido, crassiusculo, paullum reflexo, fere continuo; operculo calcareo, spirali, nucleo excentrico.*

Alt. 11, diam. 10 mm. (sp. min.).

„ 13, „ 11 „ (sp. maj.).

*Hab.* Makawe, Zululand (*Burnup*).

From the common *T. ligata*, Müll., this exceedingly handsome species differs, (*a*) in form, being narrower throughout, especially in the body-whorl; (*b*) in width of umbilicus, the perforation being both small and not particularly deep; (*c*) in clearer definition of the spiral liræ surrounding the umbilicus at the base of the body-whorl; (*d*) in colour; the principal spiral band at the periphery is of a livid black, this being well-defined—two others, which might be termed secondary or spurious zones, conspicuous for suffused bright scorched chestnut and burnt-sepia coloration, run equidistantly one on either side of the central band and parallel with it, the effect being very pleasing. The operculum is normal. Several examples.

*Chondrocyclus exsertus*, sp. n. (Pl. XXXII. fig. 11.)

*C. testa parva, gradata, depresso-conica, latissime umbilicata, albo-calcarea, periostraco omnino olivaceo contexta; anfractibus 5, quorum apicalis minutus, globularis, cæteris apud suturas excavatulis, ventricosus, sub lente minute striatis, ultimo anfractu expanso, infra peripheriam planato-declivi, umbilico perspectivunculo; apertura rotunda, peristomate tenui, simplici, continuo, denique evoluto.*

Alt. 2·20, diam. 4 mm.

*Hab.* Umkomaas and Umbogintwini, Natal (*Burnup*).



A distinct and select addition to the operculate fauna of Natal, differing from its ally, the well-known *C. convexiusculus*, Pfr., not only in colour and sculpture, but in its gradately conical spire and general elevation.

We may add that the type examples of the above, together with the types of nearly all our previously described species from South Africa, will be placed in the British Museum (Natural History).

## EXPLANATION OF THE PLATES.

## PLATE XXXI.

- Fig. 1. *Ancylus stenochorias*.
- Fig. 2. — *gordonensis*.
- Fig. 3. *Planorbis leucochilus*.
- Fig. 4. *Ennea sylvia*.
- Fig. 5. *Buliminus Burnupi*.
- Fig. 6. *Fauxulus Crawfordianus*.
- Fig. 7. *Ennea Warrenii*.
- Fig. 8. *Opeas McBeani*.
- Fig. 9. *Ennea craterodon*.
- Fig. 10. — *virgo*.
- Fig. 11. — *triglochis*.
- Fig. 12. — *dædalea*.
- Fig. 13. — *himerothales*.
- Fig. 14. — *genialis*.
- Fig. 15. — *montana*.
- Fig. 16. — *claustraria*.

## PLATE XXXII.

- Fig. 1. *Zonitoides Cupido*.
- Fig. 2. *Trachycystis permeata*.
- Fig. 3. — *scolopendra*.
- Fig. 4. *Physa zuluensis*.
- Fig. 5. *Trachycystis laticostata*.
- Fig. 6. — *patera*.
- Fig. 7. — *simplex*.
- Fig. 8. — *oreina*.
- Fig. 9. — *centrifuga*.
- Fig. 10. *Achatina parthenia*.
- Fig. 11. *Chondrocyclus exsertus*.
- Fig. 12. *Tropidophora comburens*.
- Fig. 13. *Hypolysia Florentiæ*.
- Fig. 14. *Isidora compta*.
- Fig. 15. *Trachycystis glebaria*.

LXII.—*New Hymenoptera Aculeata taken by the Swedish Zoological Expedition to Egypt and the White Nile in the Spring of 1901.* By F. D. MORICE, M.A., F.E.S.

*Nomia tegulata*, Smith. ♂.

Feminae similis; sed abdomine crassius punctato; scutello utrinque in spinam magnam compressam acutam (scapo antennae fere æquilongam) producto. Pedes simplices.

Long. circ. 7 mill.

“Abba Eiland, 12 ii. '01.”

This is not the male doubtfully assigned by M. Vachal (Miscell. Entomol. 1897) to *tegulata*, Smith, which has a simple scutellum, dilated leg-joints, &c., and is also differently coloured from the present insect. But I feel little doubt as to the determination of the latter. It was taken along with three females which exactly agree with Smith's types of *tegulata* in the South Kensington Museum, and the only characters by which it differs from them appear to me to be merely sexual. These types are all females; the author did not know the male, and it has not, I believe, been described till now.

The flagellum, mandibles, tegulae (except their membranous apices), knees, extreme apex of hind tibiae, and tarsi are rufescent, as are also more or less (but obscurely) the extreme base and sides of the abdomen and the extreme apices of its segments. The face is wide, with strongly converging eyes, which reach close to the bases of the mandibles. The head, mesonotum, and scutellum, viewed dorsally, are dull, finely rugulose, and with shallow scattered punctures. The face, pronotum above, extreme basal and apical margins of the mesonotum, and the whole postscutellum are clothed with a very dense short whitish pubescence. The scutellum is naked and its lateral margins are produced into a pair of long, compressed, sharply pointed thorns (much as in *Myrmica ruginodis*), which rise gradually above the level of the rest of the scutellum, commencing at its base, and extend far beyond it in the apical direction. Their whole length is about two thirds that of the tegulae, and of this length about one half projects over the postscutellum &c., the other half forming a lateral border to the scutellum itself. The propodeum has a short costate sulcature along its basal margin; its “area trigona” is not definitely separated from the lateral areas except by being perfectly smooth and very shining, while

they are strongly and closely punctured throughout. The mesopleuræ are somewhat rugosely punctured and the metapleuræ show a fine longitudinal striation. The first abdominal segment is largely and irregularly punctured above, the second also irregularly but not so largely, those following more finely and closely. The impressed apices of all the segments are narrowly fasciated or ciliated with whitish hairs, and there is a similar narrow fascia at the base of the second segment. The head, thorax, and bases of the legs (including the femora) are clothed beneath with moderately long white hairs; those on the tibiæ and tarsi are also white, but shorter. The posterior ocelli are about as far from each other as from the compound eyes. The legs and antennæ seem perfectly simple: in the latter joints 4 to 12 are about equal and about as broad as long; joints 3 and 13 are a little longer than the others, about half as long as the scape. The wings are hyaline, with fuscous nervures and slightly clouded apices.

*Crocisa Jägerskiöldi*, sp. n., ♂ ♀.

Nigra vel obscure cyanescens, pilositate alba (partim strata ac subsquamosa, et in certis aspectibus plus minusve cærulescente), opulentissime variegata.

Forma scutelli (apice sinuose emarginati et in medio profunde angulatim excisi) *Crocisæ scutellari* proxima; sed differt pilositate magis ut in *C. ramosa* disposita (mesonoti vittis lateralibus integris, abdominis segmenti primi basi vix interrupte fasciata etc.). Magnitudine utramque speciem multo superat (18–20 mill. long.), et ab omnibus mihi quidem cognitis *Crocisis* differt scutelli ipsius disco in utroque angulo laterali-basali macula bene definita pilositatis cærulescenti-albæ ornato.

♂. Abdominis segmentum dorsale septimum apice utrinque dentato, inter hos dentes fere recte truncato.

Antennarum articulus 3<sup>us</sup> in utroque sexu 4<sup>to</sup> fere sesquolongior.

“Khartum: ♂, 2 i. '01; ♀, 3. i. '01.”

Examples which, I think, belong to this very large and handsome species are placed in the British Museum with others, apparently *not* belonging to it, under the name *scutellaris*, F. But what recent authors (*e. g.* Friese in ‘*Bienen Europa's*’) identify with Fabricius’s species is a much smaller and less striking-looking insect, with snow-white markings, naked scutellum, and nearly naked base to the first abdominal segment.

In *Jägerskiöldi* the white pilosity in both sexes is very copious, arranged almost exactly as in *ramosa*, but with a peculiar bluish reflection in certain lights which distinguishes

it at a glance from any European species. The actual hairs seem, however, to be pure white, and it is only where they are *prostrate* that the blue effect appears. I imagine that the underlying or surrounding subcyaneous chitin is either seen through them or reflected by them in some way (the tint is just that produced by a thin layer of Chinese white over a wash of black or dark blue paint).

The almost complete absence of reliable *structural* characters, even in the males, makes the proposal of new *Crocisa* species risky and unsatisfactory; but as I can find no description which at all suits the present insects, and as Herr Friese, to whom I sent the specimens, returns them as unknown to him, I have ventured to describe them as new.

The bluish-white hair-patches *on the scutellum itself* are a very peculiar character, this part in *Crocisa* being otherwise, so far as I know, always immaculate. They are very large and subquadrate in the male, smaller and rounder in the female. The other pilose ornaments of the thorax and also those of the abdomen are arranged exactly as in *ramosa*, differing only in looking bluish, as described above. On the legs they are not blue, and (by contrast, I suppose) look even a little yellowish.

*Rhynchium Sirdari*, sp. n. ♂.

Colore omnino ut *synagroides*, sed structura alia. Clypeus semicirculariter emarginatus, angulis apicalibus spiniformibus, longitudine sua evidenter latior. Mandibulæ validæ, latæ, minus quam in *synagroide* elongatæ; margine apicali dentibus 2 in medio instructo, contiguus quidem sed bene distinctis, quorum exterior interiore duplo longius. Postscutellum, a latere visum, acute conicum: area huius basalis vel horizontalis brevis, crasse punctata, et in medio carina alta longitudinali, vel dente compresso, armata. Abdominis segmenti secundi pars ventralis, ut in *synagroide*, basi subbituberculata; sed disco læviore, punctis sparsis, magnis quidem sed minime profundis.

Long. circ. 26 mill.

Khartum, 31 i. '01.

The semicircularly emarginate clypeus, with its long spine-like angles, at once distinguishes this species from *ardens* ♂ as described by Saussure, and also from specimens called *abyssinicum* ♂ in the South Kensington Museum, which (like *abyssinicum* ♀) have a subtruncate clypeus. From *synagroides* ♂ it differs in having the clypeus evidently wider than long, the mandibles stouter, and the teeth on their apical margin better developed. Also in *synagroides* the ventral surface of the second abdominal segment is far more



strongly and deeply punctured. There is no male called *ardens* at South Kensington, and only one female, which is exceedingly unlike *Sirdari* in having its clypeus particularly narrow and elongate, with a subtruncate apex.

In *Sirdari* (at least, in the specimen before me) the orange colour extends from the apex of the abdomen to *beyond* the apex of the third segment, whereas De Saussure describes that segment as "black" simply, alike in *synagroides*, *abyssinicum*, and *ardens*; but this is probably a variable character, and might appear in any of the species in question.

*Odynerus (Ancistrocerus?) aberraticus*, sp. n. ♂.

Antennarum apices uncinato-reflexi. Abdominis segmentum 1<sup>um</sup> basin versus fortissime transverse cristatum: valde petioliforme—scilicet longissimum, apicem versus lenissime dilatatum, ibique segmento 2<sup>do</sup> rotundate-campaniformi saltem duplo angustius.

Clypei apex triangulariter excisus. Pronotum angulis inermibus. Scutellum longum, fere quadratum. Postscutellum fere in formam cristæ elevatum. Propodeum in medio late ac profunde excavatum, aræ eiusdem laterales postice conice eminentes et sub apicibus suis breviter quidem sed acute denticulatæ. Abdominis segmenti 2<sup>di</sup> pars ventralis tumidissima, quam dorsum non minus convexa, sulco costato basali pæne nullo.

Clypeus, mandibulæ, scapus antice, pronoti anguli interni, maculæ duo postscutelli pæne confluentes, pedes infra cum tibiis tarsisque totis flava. Tegulæ flavæ, nigro-notatæ. Abdominis segmenti primi apex (in dorso) anguste, secundi (et in dorso et in ventre) latius, flavo-fasciati. Reliquorum segmentorum apices plus minusve obsolete flavo picti, vel omnino nigrantes.

Caput, thorax cum propodeo, abdominisque 3 segmenta basalia satis crasse denseque punctata, subopaca: segmentorum reliquorum punctatura magis obsoleta. Latera petioli pilis albidis erectis fimbriata, dorsum eiusdem nudum. Facies et pectus strato-argenteo-subpilosus. Abdominis segmentum secundum brevissime strato-sericeo-pubescent.

Long. circ. 7 mill.

Three males, "Abba Eiland, 12 ii. '01."

I feel some hesitation in treating this curious little species as an *Ancistrocerus*, but I do not know where else to place it. Herr Kohl, who kindly examined it at my request, suggests that it may be a new species of *Nortonia*, Sauss. It does not, however, appear to me to agree at all with De Saussure's diagnosis of his genus, and is utterly unlike the species which he names as his "type" of it, viz. *O. intermedius*, Sauss. The latter, besides differing completely from

*aberraticus* in general facies, size, and coloration, has no trace of the transverse crest near the base of the petiole, which is so conspicuous in *aberraticus*, and which is generally thought, when occurring together with hook-tipped male antennæ, to mark a species as an *Odynerus* of the *Ancistrocerus* group. I am unable to follow De Saussure in considering the characters on which he founds *Nortonia* as generic, and must own that, personally, I regard *intermedius*, in spite of its peculiarities, as a *Lionotus*. At any rate, I cannot see my way to grouping *aberraticus* with it on the characters by which the Eumenidæ are at present classified.

In its elongate thorax, quadrate (not transverse) scutellum, and depressed scarious margin to the second abdominal segment *aberraticus* shows considerable resemblance to a *Microdynerus*, but none of the latter, I believe, have the base of the petiole carinated as in *Ancistrocerus*. It has some likeness also in form and puncturation to certain *Symmorphi*, but from these, *inter alia*, the hooked male antennæ separate it instantly. It is utterly unlike any *Eumenes* except in the proportions of its basal abdominal segments. Altogether this is a very singular insect, and it is quite possible that I am wrong in assigning it to any of the recognized groups of *Odynerus*, though I feel little doubt as to its claim to a place in that genus.

Savigny has figured an Egyptian species ('Planches des Insectes, &c.' pl. viii. fig. 14) (= *pharao*, Sauss., according to v. Dalla Torre's Catalogue) which I thought at first might be the insect before me. But this cannot be so, if he has given correctly the contour of the second ventral abdominal segment in his species; for this, in the lateral view which he gives of it, is nearly flat, while in *aberraticus* it is turgid and convex (almost *semicircularly* so) to an extent which I have never observed in any other *Odynerus*.

*Stizus pæcilopterus*, Handlirsch. ♂.

"Goz Abba Goma, 14 ii. '01."

The above name is used by Handlirsch to denote the "*Larra fasciata*" of Klug, a species of *Stizus* differing from that which Fabricius originally described as "*(Bembex) fasciata*" (= *Stizus fasciatus*, Handl.).

The male seems to be still undescribed. It closely resembles the female as described by Handlirsch, but the occiput, disc of mesonotum, and propodeum (*segmentum mediale*, Handl.) are black. The general ground-colour of the head and thorax (including antennæ, legs, &c.) is ferruginous red, that of the three apical abdominal segments has

a yellower tint (dark orange). The wings are coloured as in the female.

The ventral segments are simple. In the antennæ the last joint is moderately curved, narrowed to the apex, and obliquely truncated; it is hardly as long as the penultimate joint. The intermediate joints, especially 7 and 8, are somewhat flattened and dilated, widest in the middle of each joint (seen from above joints 7 and 8 are pentagonal). The third joint is about as long as the fourth and fifth together.

The sides of the thorax near the insertion of the abdomen run out into conspicuous blunt and flattened (not spine-like) productions. In the tridentate apical ventral segment the middle spine is extremely long as compared with the two lateral ones, so that, without relaxing the insect and drawing this segment right out, one might almost mistake it for a *Sphecius*.

Woking, Nov. 1903.

### LXIII.—Notes on some *Medusæ* from Japan.

By R. KIRKPATRICK, F.Z.S.

[Plate XXXIII.]

A small collection of *Medusæ* made in the Inland Sea, Japan, by Mr. R. Gordon Smith was sent by him to the Natural History Museum. The specimens, eight in number, represent three genera and species; of these, one genus and one species have not hitherto been described. The following is a list of the species:—

LEPTOMEDUSÆ: *Gonomeandrus chrysostephanus*, gen. et sp. n.

TRACHOMEDUSÆ: *Gonionemus Agassizii*, Murbach and Shearer.

DISCOMEDUSÆ: *Aurelia aurita*, Linn., var. *japonica*, Kishinouye.

#### LEPTOMEDUSÆ.

Family *Canotidæ*, Haeckel.

Subfamily *POLYORCHIDÆ*, A. Agassiz.

*GONOMEANDRUS* \*, gen. nov.

*Polyorchidæ* with four radial canals, each with an unbranched transversely meandrine proximal portion, situated on a gastric peduncle, and with a pinnately branched distal portion on the wall of the subumbrella, the branches ending

\* Μαίανδρος, the river Meander; γένος, seed.

blindly; with four main branched interradial centripetal canals, and a few adradial twigs given off from the circular canal and ending blindly. Gonads situated on the proximal portion of the radial canals, and forming transversely folded lamellæ.

*Gonomeandrus chrysostephanus* \*, sp. n.  
(Pl. XXXIII. figs. 1-4.)

Umbrella cylindrical, about  $1\frac{1}{4}$  times as high as broad, slightly contracted below, with rounded summit, and with the lower margin divided into eight adradial rounded lobes. Gastric peduncle cuboidal, with a slender stalactitic prolongation at some (or all) of its radial angles.

Stomach quadrangular, expanding down to a wide square mouth with slightly frilled margin.

Circular canal with eight loops, corresponding to the marginal lobes.

Tentacles rather short, in one series, about 80 to each lobe (or 640 in all), hollow, cylindrical, and studded with nematocyst warts in the distal half of their length.

Ocelli orange-brown, one above the base of each tentacle.

Colour in formalin: umbrella colourless and transparent; gonads pale yellow; ocelli orange-brown.

*Locality.* Inland Sea, Japan.

*Special description.*—The above genus and species are represented by only one specimen. Mr. Gordon Smith has written on the label connected with it, "The only jellyfish of the kind I saw." A detailed description is subjoined.

*Umbrella.* The dimensions are 6.5 centim. in height by 5 centim. in breadth at the upper end and 4.5 (in the contracted specimen) below. The wall has a thickness of 6 millim. in the middle of its length, but only about 3 millim. at the upper end. The eight marginal lobes are 16 millim. broad at the base and 8 millim. in length along the sagittal line; they are slightly curved inwards. The clefts between the lobes pass obliquely upwards and outwards from below, and extend much higher on the outer wall than on the inner, so that only the distal third of the lobe is completely free.

The *tentacles* are about 17 millim. in length. The proximal halves are transparent; the distal halves are opaque and (under a lens) finely granular. The tentacles are attached to the inner aspect of the margin by long slightly narrowed bases, and in such a way that the lower end of the base is flush with the outer surface.

The *velum* is moderately broad; its free edge is, as usual,

\* χρῦσσοστέφανος, with golden garland, referring to the festoons of deep orange-coloured ocelli.



circular; its attached edge follows the loops of the circular canal. The breadth of the velum at the angles of the loops is 7 millim., and midway between them, 5 millim.

The *gastric peduncle* is a cuboidal mass about 15 millim. in breadth and height, with rounded radial angles separated by interrarial grooves, *i. e.* it is quadrifoliate on transverse section. Two of the segments are prolonged each into a conical stalactitic prolongation about 20 millim. in length, round which are wound the radial canals and gonads. Probably this asymmetry is abnormal, the normal arrangement presenting four prolongations, one in each radial plane.

The *stomach* is 21 millim. in length, the breadth at the base being 5 millim. and at the mouth 15 millim. At each of the four radial angles is a thick muscle-band, which forms a rounded ridge extending from base to orifice. The four sides present many transverse folds. Probably this organ, which is well within the mouth of the umbrella, is capable of being extruded considerably beyond that orifice. The base of the stomach, which projects slightly into the peduncle, shows four radial lines meeting at the centre, these lines being furrows in continuation of the radial canals.

#### *The Gastro-vascular Canals.*

(a) The proximal unbranched portions with gonads. The four radial canals pass from the base of the stomach and proceed across the lower surface of the peduncle. Where the peduncular prolongations occur, the canals form transversely meandrine folds around them from base to apex and down again, and then continue on as similar folds on the radial aspect of the peduncle till they reach the branched gonad-free portion of the radial canals. At the apices of the prolongations, the loops arising from the folding are wound spirally round.

Where the peduncular prolongations do not exist the canals form transverse folds on the distal surface of the peduncle.

(b) The distal branched portions without gonads. The proximal join the distal portions a little beyond the base of the peduncle. The canals are pinnately and alternately branched. At first the lateral branchlets are very close together, straight, at right angles to the main canal, and either unbranched or branched only at their ends; they are given off at gradually increasing distances, and progressively make angles of from  $90^{\circ}$  to  $60^{\circ}$  with the main canal. A few of the secondary branches change their lateral course and continue in a longitudinal direction, thus filling the proximal three fourths of the interrarial regions. The ends of the vessels are club-shaped and blind, there being no anastomoses.

The four main canals are very narrow at first, and increase slightly in calibre as they proceed. They open into the apices of the four radial angles of the loops of the circular canal.

(c) The circular canal presents eight loops, corresponding with the eight lobes of the umbrella.

(d) The centripetal canals. Four main centripetal canals arise from the interradial angles of the circular canal and branch at acute angles; they occupy the lower fourth of the interradial region; the branches end blindly. A few adradial twigs and diverticula are given off from the circular canal on each side of the main radial and centripetal adradial canals. The central region of the loops is without centripetal canals.

### *Affinities.*

The position of *Gonomeandrus* is near *Polyorchis*, Agassiz. I had at first thought that the specimen belonged to the Anthomedusæ, because the peduncle was so covered with the folds of the gonads as to conceal its true nature, and I have to thank Mr. E. T. Browne for pointing out to me that this structure was simply a solid gastric peduncle; and when I found that the transverse ridges in the stomach-wall were simply folds, and that no gonads were present in that situation, it became clear that the specimen belonged to the Leptomedusæ. *Gonomeandrus* is distinguished from *Polyorchis* by its possessing transversely-folded gonadial lamellæ in place of pendent filaments, and in having narrow branching secondary canals in place of broad diverticula or simple branches given off from the radial canals.

It is worthy of note that one species of *Polyorchis* possesses a rudimentary gastric peduncle. In the figure of the specimen of *Polyorchis penicillata*, A. Agassiz, given by Fewkes (2. p. 594, pl. xxiii. fig. 3), this organ is shown with gonads dependent from it. Fewkes writes:—"The ovaries hang from the upper portion of the manubrium from a gelatinous elevation or extension of the bell which bears the proboscis." He here considers the presence of ocelli and absence of otcysts of more importance than the position of the gonads, and places the genus in the Anthomedusæ.

### TRACHOMEDUSÆ.

*Gonionemus Agassizii*, Murbach and Shearer (8. p. 185, pl. xxi. figs. 1, 2, 3). (Pl. XXXIII. figs. 5, 6.)

There are six specimens in varying stages of growth, from Naba Bay. The specimens become relatively much flatter as they increase in size, the smallest being  $5 \times 5$  millim. in breadth and height and the largest  $21 \times 9$  millim. The

tentacles, which vary in number from fifty-two to eighty, proceed from the margin at different angles, the direction of the older proceeding in a direction more backwards and upwards than the younger; the radial and interradial tentacles pass through well-marked peronial grooves, roofed over by peronia with closely apposed edges; in the younger tentacles the edges of the peronia do not meet, and in the youngest are not formed at all.

In the Japanese specimens there are more otocysts than tentacles. In one quadrant of the margin I counted thirty otocysts to twenty tentacles.

In their description (*loc. cit.*) of *G. Agassizii*, Murbach and Shearer state that there are not so many otocysts as tentacles, but that there exists no definite regularity. In the twenty intervals between the tentacles of a quadrant I counted the number of otocysts as follows—2 1 2 2 1 1 2 1 2 1 2 1 2 2 1 3 1 0 2 1—*i. e.* 30 in all, mostly alternating as 2 and 1.

Of the four known species of *Gonionemus* one, viz. *G. Murbachii*, Mayer, is found in the Atlantic (at Woods Holl, Mass.), the other three in the Pacific, *G. vertens*, A. Agassiz, occurring off British Columbia, *G. Agassizii*, Murbach and Shearer, off the Aleutian Islands and in the Inland Sea, and *G. suvaensis*, Agassiz and Mayer, off the Fiji Islands.

#### DISCOMEDUSÆ.

*Aurelia aurita*, Linn., var. *japonica*, Kishinouye.

*Aurelia japonica*, Kishinouye (4. pp. 289-291, pl. vii.).

Mr. Gordon Smith's collection contains one specimen of this form, well-preserved, excepting that the arms have been damaged.

I was unable to obtain the volume of the Zool. Mag., Tokyo, containing Kishinouye's description of *Aurelia japonica*, and learned that it was out of print; but Prof. Ijima was so extremely kind as to send me written extracts giving the descriptions of this and other species of Medusæ described in the first six volumes. Kishinouye's description runs as follows:—

“Species Diagnosis: Umbrella flat, a little vaulted, 4-5 times as broad as high. Eight velar flaps of the umbrella-margin not protruding; divided by slight shallow incisions only. Mouth-arms a little shorter than the radius of the umbrella; their margins much curled and their proximal halves with broad and strongly folded lobes. Umbrella radius four times the radius of the gonads. At every genital bay 3-5 canal-roots. Sixteen dendritically branching canals form a few meshes only.

"Colour: Transparent and white, the gonads only are slightly rose-coloured.

"Size: Diameter of the umbrella 150 millim. Height 30-35 millim."

The present specimen is 105 millim. broad and 30 millim. thick; the arrangement of its gastrovascular canals is exactly similar to that of the normal typical *A. aurita* found in the Atlantic; three canals proceed from each genital sinus, viz. a trichotomously branched interradial and two simple adradial, the three secondary branches of the interradial originating from a common point on the edge of the sinus; possibly a variation in the breadth of the common centre of origin of these branches leads Kishinouye to give 3-5 as the number of canals originating from the edge of the sinus.

The orifices of the subgenital pits are oval, and  $5 \times 4$  millim. in diameter; the cavities to which they lead stand out more clearly than in the typical *A. aurita*.

In having broad and folded lobes on the proximal halves of the mouth-arms, var. *japonica* differs from the typical *A. aurita*, but therein resembles *A. aurita*, var. *cruciata*, Haeckel, the typical form being "nicht gelappt," and the var. *cruciata* "gelappt" (3. pp. 553, 644). The radius of the umbrella is three times that of the gonads.

If, as Vanhöffen (10. p. 43) and Maas (6. p. 26) assume, *Aurelia colpota*, Brandt, is only a variety of *Aurelia aurita*, then the distribution of *Aurelia aurita* extends over the Atlantic, Indian, and Pacific Oceans.

Nine species of *Aurelia* are described in Haeckel's 'System,' viz. *A. aurita*, Linn.; *cruciata*, Haeckel; *colpota*, Brandt; *flavidula*, Péron and Lesueur; *marginalis*, L. Agassiz; *hyalina*, Brandt; *labiata*, Chamisso and Eysenhardt; *clausa*, Lesson; and *limbata*, Brandt.

The following five have since been described:—

*A. dubia*, Vanhöffen (9. p. 20). Persian Gulf.

*A. habanensis*, Mayer (7. p. 69, pl. xxiv. figs. 3, 4; pl. xxvi. fig. 86). Tortugas and Havana.

*A. japonica*, Kishinouye (4. pp. 289-291, pl. vii.). Inland Sea, Japan.

*A. vitiana*, Agassiz and Mayer (1. p. 171, pl. x. fig. 35). Fiji Islands.

*A. cærulea*, Lendenfeld (5. p. 280). Port Jackson, N.S.W.

Of these five, *A. vitiana* is, according to Maas (6. p. 26), synonymous with *Aurelia aurita*, var. *colpota*, Brandt. *A. dubia*, *habanensis*, and *japonica* may also be regarded as varieties of *Aurelia aurita*. *A. cærulea* belongs to Haeckel's subgenus *Aurelissa*, including *A. limbata*, *labiata*, and *clausa*.



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## EXPLANATION OF PLATE XXXIII.

Fig. 1. *Gonomeandrus chrysostephanus*. Nat. size.

Fig. 2. The same, laid open. *a*, stomach; *b*, peduncle; *c*, gonads on proximal portion of radial canals; *c'*, roots of four radial canals proceeding from base of stomach; *c''*, a prolongation of peduncle; *c'''*, gonadal filament or diverticulum; *d*, branched portion of radial canal; *e*, circular canal; *f*, a main centripetal circular canal; *g*, velum; *h*, tips of marginal lobes showing below velum.

Fig. 3. Diagrammatic transverse section at base of stomach. *a*, base of stomach; *b*, four radial canals; *c*, lobes of peduncle.

Fig. 4. Roots of tentacles opening into *a*, the circular canal. One tentacle showing distal portion with nematocyst warts,  $\times 10$  diameters.

Fig. 5. *Gonionemus Agassizii*, Murbach and Shearer, edge of umbrella. *a*, edges of peronia; *b*, bulbs rich in large nematocysts, at base of each tentacle; *c*, otocyst.

Fig. 6. Otocyst of *G. Agassizii*.  $\times 325$ . *a*, otolith in centre of stalked auditory club and surrounded by partly columnar, partly rounded, endoderm cells; *b*, auditory hairs.

LXIV.—*Descriptions of new South-American Fishes in the Collection of the British Museum.* By C. TATE REGAN, B.A.

*Pristigaster (Opisthopterus) effulgens.*

Depth of body  $3\frac{3}{4}$  times in the total length, length of head 5 times. Diameter of eye  $3\frac{1}{2}$  times in the length of head and twice the interorbital width. Snout shorter than diameter of

eye. Maxillary more than half the length of head. Sc. 56/13. D. 11. A. 65. Distance from origin of dorsal to base of caudal  $1\frac{3}{4}$  times in that from tip of snout to origin of dorsal. Pectoral longer than the head. Dark above, silvery on sides and below.

Total length 226 mm.

A single specimen from the Rio Vaqueria, N.W. Ecuador.

This species is distinguished from *P. Dovii*, Gthr., its nearest ally, by the larger mouth and more numerous anal rays.

*Ophichthys (Pisodontophis) brevimanus.*

Depth of body about 21 times in the total length, length of head about  $8\frac{1}{2}$  times. Anal opening equidistant from tip of snout and posterior end of body. Diameter of eye 16 times in the length of head and  $2\frac{2}{3}$  times in the length of snout, which is  $1\frac{3}{4}$  times the distance from eye to posterior angle of mouth. Teeth granular. Dorsal commencing above tip of pectoral, which is short, its length  $9\frac{1}{2}$  times in that of the head. Dark bluish grey above, lighter below; numerous dark spots on the head; dorsal dark, with a narrow light margin; anal light.

Total length 630 mm.

A single specimen from the Rio Vaqueria, near La Tola, N.W. Ecuador.

*Piabucina astrigata.*

Depth of body  $4\frac{1}{2}$ –5 times in the total length, length of head about  $4\frac{1}{2}$  times. Snout as long as the eye, the diameter of which is  $4\frac{1}{3}$ – $5\frac{1}{2}$  times in the length of head, interorbital width  $2\frac{1}{3}$ – $2\frac{1}{2}$  times. Maxillary extending to below middle of eye; mandibular rami well separated, the interspace somewhat narrowed anteriorly, but not tapering to a point. Sc. 28–29/8. D. 11 8, its origin nearly equidistant from the posterior edge of the postorbitals and the base of caudal. A. 11 9. Pectoral  $\frac{2}{3}$ – $\frac{3}{4}$  the length of head. Ventrals extending a little more than half the distance from their base to the origin of anal (in the adult) or nearly  $\frac{2}{3}$  of that distance (in the young). Caudal bilobed. Caudal peduncle  $1\frac{1}{5}$ – $1\frac{1}{3}$  times as long as deep. Olivaceous above, lighter below. A dark spot on the base of caudal. In the young a series of large dark spots along the middle of the side, most conspicuous posteriorly.

Total length 185 millim.

Five specimens from St. Javier, Paramba and the Rio Sapayo, N.W. Ecuador.

*Piabucina pleurotænia.*

Depth of body  $4\frac{1}{4}$ – $5\frac{1}{2}$  times in the total length, length of head  $4\frac{1}{3}$ – $4\frac{2}{3}$  times. Snout as long as or longer than the eye, the diameter of which is  $4\frac{2}{3}$ –6 times in the length of head, interorbital width  $2\frac{1}{2}$ – $2\frac{3}{4}$  times. Maxillary extending to below anterior  $\frac{1}{3}$  of eye; mandibular rami well separated, the interspace somewhat narrowed anteriorly, but not tapering to a point. Sc. 30–32/8. D. 11 8, its origin nearly equidistant from middle of eye and base of caudal. A 11 9. Pectoral  $\frac{2}{3}$ – $\frac{3}{4}$  the length of head. Ventrals extending less than  $\frac{1}{2}$  the distance from their base to the origin of anal (in the adult) or  $\frac{2}{3}$  of that distance (in the young). Caudal bilobed. Caudal peduncle  $1\frac{1}{5}$ – $1\frac{1}{3}$  times as long as deep. A dark longitudinal stripe along the middle of the side, ending in a dark spot on the base of caudal.

Total length 160 mm.

Six specimens from Merida, Venezuela, 1600 metres, collected by Sr. Briceño.

This species differs from the preceding in the smaller eye, different position of the dorsal, coloration, &c. Both are distinguished from *P. unitteniata*, Gthr., and *P. elongata*, Blgr., by the broader interspace between the mandibular rami, and from *P. erythrinoides*, C. & V., by the fewer scales.

*Trichomycterus vittatus.*

Length of head  $6\frac{1}{4}$  times in the total length. Head as broad as long. Diameter of eye  $2\frac{1}{3}$  times in the interocular width, which is  $3\frac{1}{2}$  times in the length of head. Snout slightly shorter than the postorbital part of head. Barbels equal to  $\frac{4}{5}$  the length of head. Dorsal with 6 branched rays, originating in advance of the anal opening, the distance from its point of origin to the caudal  $1\frac{1}{2}$  times in the distance from the former to the tip of snout. Anal with 4 branched rays, originating slightly behind the vertical from the last dorsal ray, the distance from the base of its last ray to the caudal  $4\frac{1}{2}$  times in the total length. Longest branched ray of pectoral  $\frac{3}{4}$  the length of the simple outer ray, which is as long as the head. Ventrals extending  $\frac{2}{3}$  of the distance from their base to the origin of anal. Caudal truncate. Head and body with dark spots; a dark longitudinal stripe along the middle of the side.

Total length 78 mm.

One specimen from the Marcapata Valley, E. Peru, collected by Mr. Ockenden.

Allied to *T. Kneri*, Std., which has the head longer than broad and the caudal emarginate.

*Trichomycterus retropinnis.*

Length of head  $5\frac{1}{2}$  times in the total length. Head as broad as long. Diameter of eye about 4 times in the interocular width, which is  $3\frac{1}{2}$  times in the length of head. Snout as long as the postorbital part of head. Barbels equal to about  $\frac{4}{5}$  the length of head. Dorsal with 6 branched rays, originating above or slightly behind the anal opening, the distance from its point of origin to the caudal  $2\frac{2}{5}$  times in the distance from the former to the tip of the snout. Anal with 4 branched rays, originating below the anterior third of the dorsal, the distance from the base of its last ray to the caudal  $5\frac{2}{3}$  times in the total length. Longest branched ray of the pectoral  $\frac{2}{3}$  the length of the simple outer ray, which is equal to  $\frac{5}{6}$  the length of head. Ventrals not quite reaching the anal opening. Caudal truncate-rounded. Brownish, with an indistinct darker stripe along the middle of the side and traces of some dark spots.

Total length 80 mm.

Two specimens from St. Augustin, Andes of Colombia, 5000 feet, collected by Capt. Dowding.

A third specimen, 30 mm. in total length, which I have purposely excluded from the above diagnosis, has a well-marked broad longitudinal stripe on each side. In it the longest branched ray of the pectoral is  $\frac{5}{6}$  the length of the outer simple ray, and the distance from the origin of the dorsal to the caudal is  $2\frac{1}{3}$  times in the distance from the former to the tip of the snout.

Allied to *T. nigromaculatus*, Blgr., and *T. amazonicus*, Sldr.; in the position of the dorsal fin intermediate between the two.

*Trichomycterus meridae.*

Length of head 6–7 times in the total length. Head as long as, or longer than, broad. Diameter of eye about 3 times in the interocular width, which is about 3 times in the length of head. Snout considerably shorter than the postorbital part of head, scarcely longer than the interocular width. Barbels as long, or nearly as long as the head. Dorsal with 6 or 7 branched rays, originating a little in advance of the anal opening, the distance from its point of origin to the caudal  $1\frac{2}{3}$ – $1\frac{4}{5}$  times in the distance from the former to the tip of the snout. Anal with 4 or 5 branched rays, originating below the last 2 or 3 rays of the dorsal, the distance from the base of its last ray to the caudal  $4\frac{2}{3}$ –5 times in the total length. Longest branched ray of the pectoral  $\frac{2}{3}$  the length of



the simple outer ray, which is  $1\frac{1}{3}$  times as long as the head. Ventrals extending to the anal opening. Caudal truncate. Head and body with rather large dark spots; dorsal and caudal dusky.

Total length 125 mm.

Eight specimens from Merida, Venezuela, and from the Rio Albireggas, above Merida, altitude 3500 metres, collected by Sr. S. Briceño.

Allied to *T. brasiliensis*, Ltkn., but with a shorter head and more elongate body.

*Pimelodus (Pimelodella) tæniophorus.*

Depth of body  $5\frac{1}{2}$  times in the total length, length of head  $4\frac{1}{2}$  times. Head  $1\frac{1}{2}$  times as long as broad. Diameter of eye  $3\frac{1}{2}$  times in the length of head, interorbital width 4 times. Snout equal in length to the postorbital part of head. Maxillary barbel extending to base of caudal, postmental barbel to extremity of pectoral. D. I 6, the spine slender, its length  $1\frac{1}{2}$  times in that of the head. Length of adipose fin about  $2\frac{4}{5}$  times in the total length. A. III 8. Pectoral spine extending to below the third or fourth branched ray of the dorsal, stout, with about 12 teeth on its inner edge, the longest equal in length to about  $\frac{2}{5}$  the breadth of the spine. Ventrals originating below the last dorsal ray, extending  $\frac{3}{3}-\frac{3}{4}$  of the distance from their base to the anal. Caudal forked, the inner rays  $\frac{1}{3}$  the length of the outer. A well-developed black lateral stripe extending from the snout, through the eye, to the base of caudal.

Total length 85 mm.

Two specimens from Descalvados, Matto Grosso, collected by Dr. Ternetz, referred by Boulenger to *P. lateristriga* in his account of the Ternetz collection. This species is allied to *P. vittatus*, Ltkn., but differs in having much longer barbels, longer adipose fin, and longer pectoral spine.

*Pimelodus (Pimelodella) griseus.*

Depth of body 5 times in the total length, length of head  $4\frac{1}{4}$  times. Head  $1\frac{1}{3}$  times as long as broad. Diameter of eye 4 times in the length of head and equal to the interorbital width. Snout equal in length to the postorbital part of head. Maxillary barbel extending to extremity of ventral, postmental barbel to middle of pectoral. D. I 6, the spine moderately stout, nearly smooth, its length  $1\frac{3}{4}-1\frac{3}{4}$  times in that of the head; longest branched ray nearly as long as the head. Length of adipose fin nearly 4 times in the total length.

A. III 8-9. Pectoral spine extending to below the first branched ray of the dorsal, stout, with 12-16 strong teeth on its inner edge, the longest nearly equal in length to the breadth of the spine. Ventrals originating behind the vertical from the last dorsal ray, extending  $\frac{4}{5}$  of the distance from their base to the anal. Caudal forked, the upper lobe pointed, a little longer than the lower, which is rounded. Inner caudal rays half as long as the outer. Greyish; a narrow dark stripe along the middle of the side of the body; a dark streak on the membrane in front of each dorsal ray.

Total length 140 mm.

Three specimens from the Durango, Sapayo and Vaqueria Rivers, N.W. Ecuador.

This species is distinguished from *P. lateristriga*, Müll. & Trosch., by the longer head, shorter and stouter dorsal spine, and less deeply forked caudal.

*Haplochilus peruanus.*

Depth of body about 5 times in the total length, length of head 4 times. Snout a little shorter than eye, the diameter of which is  $3\frac{1}{2}$ - $3\frac{2}{3}$  times in the length of head, interorbital width twice. Sc. 45/14. D. 9-10. A. 13-15. Distance from origin of dorsal to base of caudal about  $2\frac{2}{3}$  times in that from origin of dorsal to tip of snout. Pectoral nearly  $\frac{3}{4}$  the length of head, extending  $\frac{1}{2}$  the distance from its base to the origin of anal. Ventrals not or scarcely reaching anal opening. Brownish, with small dark spots on the vertical fins.

Total length 55 mm.

Two specimens from Perim, Peru, 800 metres, collected by the late Mr. P. O. Simons.

*Belone fluviatilis.*

Length of head about  $2\frac{2}{3}$  times in the total length. Diameter of eye  $3$ - $3\frac{1}{3}$  times in the length of postorbital part of head and equal to the interorbital width. Snout twice as long as the rest of head. Lower part of maxillary exposed for its whole length. D. 15-16, the anterior rays elevated, the posterior short, subequal in length. A. 17-18, commencing a little in advance of the dorsal, its longest rays a little longer than those of the dorsal and equal to the length of pectoral, which is  $4\frac{3}{4}$ -5 times in the length of head. Origin of ventrals nearly equidistant from posterior part of eye and base of caudal. Caudal slightly emarginate. Caudal

peduncle subcylindrical, neither distinctly compressed nor depressed, without keel. 180–200 scales in front of the dorsal. A silvery lateral stripe, becoming broader posteriorly; a more or less distinct dark spot above the base of pectoral.

Total length 450 mm.

Three specimens from the rivers of N.W. Ecuador.

This species appears to be nearest to *B. scapularis*, Jord. & Gilb., from which it is distinguished by the longer head, smaller eye, and more numerous scales.

*Centropomus atridorsalis.*

Depth of body  $3\frac{1}{2}$  times in the total length, length of head  $2\frac{3}{4}$  times. Diameter of eye 5 times in the length of head, interorbital width  $6\frac{1}{4}$  times. Length of snout  $1\frac{1}{4}$  times the diameter of eye. Maxillary extending to below middle of eye, the breadth of its distal extremity equal to  $\frac{1}{2}$  the diameter of eye. Præorbital with 5–7 serræ. Anterior ridge of præoperculum with 2 spines, posterior margin serrated, with 2 or 3 spines at the angle. 13 gill-rakers on the lower part of anterior arch, the longest equal to  $\frac{2}{3}$  the diameter of eye. Sc.  $52\frac{6}{13}$ . D. VIII, I 10, the third and fourth spines the longest, equal to  $\frac{1}{2}$  the length of head. A. III 7, the length of the third spine  $1\frac{2}{3}$  times in that of the second, which is equal to  $\frac{7}{8}$  the length of head and, when laid back, extends beyond the base of caudal. Pectorals and ventrals extending to the level of the anal opening. Inner caudal rays half as long as the outer. Lateral line blackish. Membrane of dorsal and caudal fins and that between the second and third spines of the anal blackish; fins otherwise pale.

Total length 160 mm.

One specimen from the Rio Vaqueria, near La Tola, N.W. Ecuador.

This species is readily distinguishable from others with a blackish lateral line by the great length of the second anal spine.

*Corvina Crawfordi.*

Depth of body equal to the length of head,  $3\frac{2}{5}$  times in the total length. Snout  $1\frac{2}{7}$  times as long as the diameter of eye, which is  $5\frac{1}{2}$  times in the length of head; interorbital width  $3\frac{1}{3}$  times. Depth of the præorbital slightly greater than the diameter of eye. Maxillary extending slightly beyond the vertical from the anterior margin of the eye, its length  $2\frac{5}{8}$  times in that of the head. Jaws with bands of small, pointed

teeth, those of the outer series of the upper jaw enlarged; no canines. Posterior border of præoperculum dentated, the angle with two fairly strong spines, the lower pointing downwards. Gill-rakers equal in length to  $\frac{1}{3}$  the diameter of eye, 16 on the lower part of the anterior arch. D. X, 1 28, the third and fourth spines the longest, equal to  $\frac{2}{3}$  the length of head. A. II 8, originating below the thirteenth branched ray of the dorsal, the second spine stout, equal to  $\frac{1}{3}$  the length of head. Pectoral pointed, equal to  $\frac{4}{5}$  the length of head. Ventral spine equal to  $\frac{1}{2}$  the length of pectoral, the outer branched ray with a short terminal filament, extending nearly as far back as the pectoral. Caudal doubly truncate. Scales finely ciliated, arranged in vertical series both above and below the lateral line, 55 in a longitudinal series, 6 between the base of the first dorsal spine and the lateral line. Depth of caudal peduncle  $2\frac{2}{3}$  times in the distance from the base of the last anal ray to the caudal. Olivaceous above, silvery on the sides and below; upper half of the body with brownish stripes, which posteriorly run horizontally along the middle of each series of scales and anteriorly curve downwards and run vertically. Membrane of the fins dusky.

Total length 250 mm.

A single specimen, obtained at Montevideo by Mr. M. J. Nicoll during the voyage of the 'Valhalla,' and presented to the British Museum by Lord Crawford.

*Acara sapayensis.*

Depth of body  $2\frac{2}{3}$  times in the total length, length of head  $2\frac{5}{6}$  times. Diameter of eye  $3\frac{1}{3}$  times in the length of head, interorbital width  $2\frac{3}{4}$  times, length of snout  $2\frac{4}{5}$  times. Maxillary extending to the vertical from the anterior margin of eye; breadth of præorbital equal to  $\frac{3}{4}$  the diameter of eye; cheek with 3 series of scales; 5 gill-rakers on the lower part of the anterior arch. Sc.  $26\frac{3}{8}$ . L. lat. 15-17+8-9. D. XV 10, the spines increasing in length to the last, which is equal to  $\frac{3}{4}$  the length of head; the soft fin pointed, the fourth and fifth rays longest, extending to beyond the middle of caudal. A. III 8, the first spine half the length of the second, the second  $\frac{3}{4}$  the length of the third, which is equal to  $\frac{2}{5}$  the length of head. Pectorals and ventrals extending to the level of the origin of anal. Caudal truncate rounded. Length of caudal peduncle  $1\frac{1}{3}$  times in its depth. Dark brown, with 6 obscure blackish cross-bands on the upper half of the body; some small blue spots on the head; fins blackish.



Total length 115 mm.

One specimen from the Rio Sapayo, N.W. Ecuador.

This species is allied to *A. cæruleopunctata*, Stdr., which has a smaller eye and shorter caudal peduncle.

*Gobius (Awaous) Guentheri.*

*Gobius transandeanus* (part.), Günth. Cat. iii. p. 62 (1861).

Depth of body  $6\frac{1}{2}$  times in the total length, length of head 3 times. Breadth of head  $1\frac{1}{6}$  times in its length, depth of head  $2\frac{1}{6}$  times. Diameter of eye  $6\frac{1}{3}$  times in the length of head, length of snout  $2\frac{1}{3}$  times, length of maxillary twice. Maxillary extending to the vertical from the anterior margin of the eye. Osseous interorbital width  $\frac{2}{5}$ – $\frac{2}{3}$  of the diameter of eye. Scales ciliated, 60–63 in a longitudinal series, 17–18 in an oblique series from the origin of the second dorsal backwards to the anal, about 30 in front of the first dorsal. D. VI, I 10, the spines of the first fin more or less produced, the second and third the longest; distance from origin of first dorsal to posterior margin of eye equal to the distance from that point to the tip of snout; rays of the second dorsal subequal, half the length of head. A. I 10, the length of the rays  $2\frac{1}{2}$ – $2\frac{3}{4}$  times in that of the head. Pectoral pointed, its length  $1\frac{2}{5}$ – $1\frac{3}{5}$  times in that of the head. Ventrals extending  $\frac{2}{3}$  of the distance from their base to the origin of anal. Caudal rounded. Head and upper part of body spotted or marbled with dark brown; second dorsal with longitudinal, caudal with vertical dark lines; pectoral with a dark bar on the base of the upper rays; ventrals and anal blackish.

Total length 140 mm.

Two specimens from Western Ecuador.

It is here desired to restrict the name *G. transandeanus* to a species which differs from the above notably in the following features:—Length of head  $3\frac{1}{3}$  times in the total length. Length of maxillary  $2\frac{3}{4}$  times in that of the head, length of snout  $2\frac{2}{5}$ – $2\frac{2}{3}$  times. Maxillary not reaching the vertical from the anterior margin of eye. 35–40 scales in front of the dorsal. Distance from origin of dorsal to posterior margin of eye  $1\frac{1}{4}$  times the distance from that point to the tip of snout. Ventrals and anal pale.

This diagnosis is based on four specimens from W. Ecuador, measuring up to 175 mm. in total length.

*G. Guentheri* is closely allied to *G. latus*, O'Shaughnessy, which is distinguished by the fewer scales. This latter species is not a synonym of *G. banana*, C. & V., but is the one which American authors have identified with *G. flavus*,

C. & V., without good reason, since *G. flavus* is described as having "la bouche fendue jusque sous l'arrière de l'œil," whereas in *G. latus* the cleft of the mouth barely extends to below the middle of the eye. Moreover, it appears to me to be unjustifiable to place *G. banana*, C. & V., in the synonymy of *G. taiasica*, Lichtenstein. The description of this latter species is entirely inadequate, but as it is said to come from Brazil it is more probably identical with *G. latus* than with *G. banana*, which has been recorded from the Antilles and from Central America.

*Chasmodes maculipinna.*

Depth of body 4 times in the total length, length of head  $3\frac{1}{5}$  times. Snout concave, equal in length to the eye, the diameter of which is  $4\frac{1}{4}$  times in the length of head. Inter-orbital space narrow, concave. Maxillary extending to below posterior  $\frac{1}{3}$  of eye. D. XII 14, a notch between spinous and soft-rayed portions, the latter the higher, its longest rays equal to the postorbital part of head. A. 18. Pectoral equal to  $\frac{2}{3}$  the length of head. Anterior part of dorsal with a large black spot, extending from the first to the fourth spine.

Total length 63 mm.

A single specimen from the Rio Durango, N.W. Ecuador.

LXV.—*Notes on Scapholeberis aurita (S. Fischer), a Cladoceran new to Britain.* By ROBERT GURNEY, B.A., Sutton Broad Laboratory.

THE only species of the genus *Scapholeberis* hitherto recorded as British is *S. mucronata* (O. F. Müller), but I have now to add *S. aurita*, which I have recently found in three localities in Norfolk. Considering the peculiar swimming habits of *S. mucronata*, as described by Mr. Scourfield \*, it may be of interest to compare the two species in this respect, and also with regard to certain points in their structure.

In both species the ventral margin of the shell-valves is flattened, but this area is proportionally larger in *S. aurita* and is bounded externally by a very prominent ridge and internally by the thickened edge of the valve. This thickening of the edge, which is quite conspicuous, is not continued the

\* Journ. Linn. Soc., Zool. vol. xxy. pp. 1-19 (1894).

whole length of the valve, but near the anterior end is continuous with an obliquely transverse ridge which joins the external ridge (fig. 1). There is thus marked off in front a

Fig. 1.



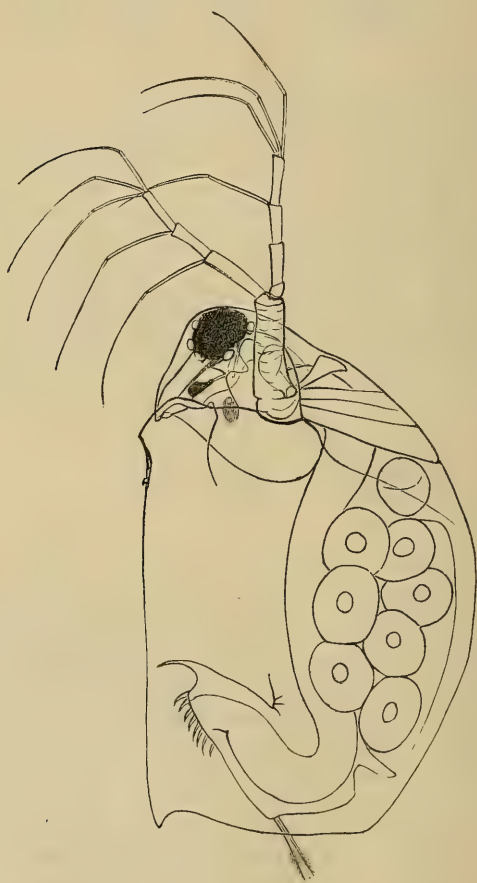
more or less triangular area which is somewhat depressed and strongly reticulate. The remaining portion of the valves in *S. aurita* is not reticulate, but simply punctate.

Seen from the side (fig. 2) the shell-margin is almost straight, but with a prominent projection anteriorly corresponding to the point of union of the transverse and external longitudinal ridges.

So far the two species are in essential agreement, but they differ strikingly in the armature of the flattened area. In *S. mucronata* this area is provided with a number of peculiarly arranged scales and modified setæ (see Scourfield, pl. ii. fig. 1), but nothing of the kind occurs in *S. aurita*. Here the flattened area shows no setæ whatever, and the setæ which fringe the inner edge of the valves are quite simple and delicate. On the other hand, careful examination of the inner longitudinal thickening shows a series of small upwardly

projecting teeth, indicated in fig. 1. There may be from five to eight of these teeth, the first (which is the largest) placed just at the junction of the transverse and inner longitudinal ridges, and the remainder along the latter to a point about halfway along the shell. They increase somewhat in size from before backwards.

Fig. 2.



Now it has been shown by Scourfield that it is by means of the modified setæ of its flattened shell-margin that *S. mucronata* supports itself from the surface-film, and it might be supposed that *S. aurita*, lacking these setæ, would



not have the same habit. It does indeed differ in some respects from its relative, being much less active in its movements, and also it does not always, as Lilljeborg \* has already pointed out, swim upon its back. In fact its movements are somewhat aimless, and it seems likely that this is due to the almost total absence of the spinous posterior prolongations of the valve, which, like the spines of Decapod zoëas, may serve in *S. mucronata* as directive organs. But it has exactly the same habit of swimming on its back suspended by the surface-film. If it is examined in this position in the way recommended by Scourfield—namely, by brightly illuminating the surface of the water, and then focussing a lens upon the animal—it can be seen that where it touches the surface there are two rows of minute breaks in the surface-film, between which the swimming-legs may be seen moving. These breaks have the appearance of elevations, but it is very difficult to distinguish an elevation from a depression when of such minuteness. I believe that these breaks are made by the small teeth upon the inner longitudinal ridge, and that they are actually depressions caused by these teeth piercing the surface-film. If that is so, we have an interesting case of the same end being attained by widely different structures. It would be very instructive to know whether in *S. microcephala* there is yet a third arrangement for the same purpose.

These teeth appear also to be used by *S. aurita* for temporary attachment to submerged objects, such as the sides of a glass vessel in which it is contained. One other point may be alluded to, namely, the colour. In all the specimens of *S. aurita* which I have seen the colour is more or less deep orange, though it varies greatly according to Lilljeborg. There is no localized distribution of the pigment about the ventral surface such as obtains in *S. mucronata* and has been explained as a protective modification.

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LXVI.—*Three new Bats from the Cameroons, discovered by Mr. G. L. Bates.* By OLDFIELD THOMAS.

*Nycteris arge*, sp. n.

Allied to *N. thebaica*, but with much smaller tragus.

Size medium. General colour dark brownish above and below. Nose-leaf of normal structure, but unusually thickly

\* 'Cladocera Sueciæ,' 1900, p. 164.

hairy. Ears of average size, the projecting lobule at their outer bases very strongly developed, inverted, deeply concave externally, convex internally. Tragus with its free portion, as in *N. thebaica*, expanded above and convex on its inner margin, but the free portion itself is barely one third its size in the allied species, the distance from its inner base to its tip considerably less than the distance from the same point to the base of the outer margin.

Upper incisors deeply bifid; second lower premolar nearly half the size of the first, in the tooth-row.

Dimensions of the type (measured in spirit):—

Forearm 45 mm.

Head and body 52; tail 48; lower leg and foot (s. u.) 32·5; head 21·5; ear 28; inner margin of tragus 2·5.

*Hab.* Efulen, Cameroons.

*Type.* Adult male. Collected by Mr. G. L. Bates. Two specimens.

This *Nycteris* is readily distinguishable by the extremely small size of the free portion of the tragus, which is otherwise similar in shape to that of *N. thebaica*.

*Miniopterus inflatus*, sp. n.

Colour of *M. scotinus*. Size larger than in *M. Schreibersi*.

Fur of back about 4 mm. in length, its texture about as in *M. scotinus*, not extending on to the interfemoral or wing-membranes except close to the sides below. Colour uniform dark "seal-brown" above, rather paler below. Ears and membranes black.

Skull markedly larger than in *M. Schreibersi*, therefore still more exceeding that of the similarly coloured *M. scotinus*.

Dimensions of the type:—

Forearm 46 mm.

"Head and body 65; tail 48; hind foot 7; ear 11" (*G. L. B.*).

Skull: greatest length 16·7; basal length in middle line 12·3; front of incisors to back of  $m^3$  7·8.

*Hab.* Efulen, Cameroons.

*Type.* Adult skin (male). B.M. no. 3. 2. 4. 8. Collected 24th July, 1901, by Mr. G. L. Bates.

This *Miniopterus* is at once distinguishable from *M. Schreibersi* by its dark colour and large head, and from *M. scotinus* and *M. Newtoni* by its much larger size.

*Nyctinomus thersites*, sp. n.

A medium-sized species, with proportionally short limbs, united ears, separated premaxillæ, and very small lower check-teeth.

Body large as compared with the short forearms and legs. Muzzle short, upper lip distinctly furrowed. Ears short, opaque, their tips broadly rounded; inner margins united at base; anterior margin without minute horny points; antitragus as high as long, with a deep notch behind it; keel thickened below, but not flattened externally. Tragus minute, almost linear; a separate, very distinct, external basal projection developed halfway between its outer base and the inner side of the antitragus. Fur short, close, and velvety; hairs of back barely  $2\frac{1}{2}$  mm. long, tufts\* of long hairs (about  $\frac{1}{2}$  inch in length) placed on each side of the rump; fur confined to body throughout, except a narrow rim along each side below. Colour dark brownish chestnut, the glandular hairs behind the junction of the ears black. Penis projecting but little from the surrounding flesh, without special scent-glands.

Premaxillæ separated, but the opening between them small; anteorbital crests scarcely developed; sagittal crest low; lambdoid crest strong, forming a prominent projection on each side of the middle line. Lower jaw unusually thick and heavy.

Upper incisors thick, vertical, parallel, well separated. Anterior premolar small, but standing in the tooth-row, and separating the canine from the large premolar. Lower incisors four, bifid, overlapping. Lower premolars very abnormal in being subequal, the anterior scarcely shorter than the posterior. Molars unusually low-crowned, their vertical height considerably less than that of the thick mandibular ramus.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 41 mm.

Head and body 75; tail 32; ear 17; tragus on inner edge 1·2; third finger, metacarpus 40, first phalanx 17, second phalanx 16; fifth finger, metacarpus 26, first phalanx 9, second phalanx 4; lower leg 15, lower leg and foot (s. u.) 23.

Skull: greatest length 20; zygomatic breadth 12·5; front of canine to back of  $m^3$  7·3.

*Hab.* Efulen, Cameroons.

*Type.* Old male. Collected by Mr. G. L. Bates. Three specimens.

By Dobson's synopsis this bat comes near *N. pumilus*, but may be readily distinguished from that species by its larger size and the many peculiarities, external and cranial, described above.

\* These tufts appear to occur in many species, though seldom so well developed as in the present animal.

LXVII.—*Description of a new Species of African Hesperinae.* By HAMILTON H. DRUCE, F.Z.S., F.E.S.

*Leucochitonea Hindei*, sp. n.

♂.—*Upperside.* Allied to *L. levubu*, Walleng., from which it differs on the fore wing by broader black apical and outer-marginal borders, containing differently placed white spots. The black apex extends irregularly almost to the wall of the cell. The second and third spots of the subapical series are shorter than in *L. levubu*, consequently this band has an irregular appearance. The black outer margin extends broadly to the angle and contains one more white spot than is usual in *L. levubu*, viz. two in the space between the lower median nervule and the submedian nervure. The marginal row of white spots which in *L. levubu* is composed of spots of almost uniform size, is in *L. Hindei* much more irregular, the apical four being small, the next two large, whilst the remaining two near the angle are again small.

The hind wing has the black margin slightly broader than in *L. levubu*.

The abdomen is white, with a broad black central stripe, the cilia chequered, the coxæ orange at the base, and the anal tuft black and white, as in *L. levubu*.

*Underside.* Fore wing as above. Hind wing as above, but with the costal nervure black from its base to its apex and a black basal suffusion between the anal margin and the submedian nervure. Antennæ black, whitish on underside of clubs. Legs black and white. Head black, with white spots.

♀.—Differs from the male by having a thick anal tuft of yellowish hairs, as in *L. levubu* ♀.

Expanse as in *L. levubu*.

*Hab.* Kitui, British East Africa (about 4000 feet) (*S. L. Hinde*).

This species, which I have named after its captor, Mr. S. L. Hinde, who took it in December 1900 (3 ♂, 1 ♀), is also allied to *L. amneris*, Rebel and Rogenhofer, described in Dr. Oscar Baumann's 'Through Massailand to the Sources of the Nile,' p. 338 (Berlin, 1894). *L. amneris* is described as being without the black veins of *levubu*, but with the black apical marking much broader and the "border spots" smaller and more rounded. It was captured in the Kiwaya Desert and at Umbugwe, which is south-west of Kilima-Njaro.

Mr. Hinde presented his specimens to the University Museum, Oxford, where the types now remain.

Plötz, in the 'Journal of the Entomological Society of Stettin,' 1885, p. 36, describes *Sapœa lactea*, but does not



compare it with any other species, and gives as locality "Africa." He states it is figured in his Hesp. t. 857, which has never been published, and is now lost.

The description agrees, so far as it goes, with *L. levubu*, and in the British Museum it is placed as a synonym of that species, with which I thoroughly agree. Dr. Holland does not mention it in his Revision of the African Hesperiidæ (P. Z. S. 1896). Dr. Trimen (P. Z. S. 1891) writes of specimens of *L. levubu* from South-west Africa as having the black on the margins and nervules more developed than those from more southern tracts.

There is also a specimen in the Oxford Museum from the Loangwa Valley, Mushinga Mountains, British Central Africa, collected in August by Mr. C. H. Pemberton, and presented by Mr. C. V. A. Peel, which agrees exactly with the specimen in the same museum captured by the late F. Oates in Matabele Land in March, and referred to by Westwood in Oates's 'Matabele Land' (London, 1881, p. 335).

Rebel and Rogenhofer give the expanse of *L. amneris* as 35 mm., while Plötz gives that of *L. lactea* as 19 mm.

#### BIBLIOGRAPHICAL NOTICES.

J. H. FABRE. *Souvenirs Entomologiques (Huitième Série): Études sur l'Instinct et les Mœurs des Insectes.* 8vo. Paris, 1903. Pp. 379.

EVERY few years this indefatigable observer of insect-life enriches our entomological libraries with interesting information, at first hand, on the habits and metamorphoses of various insects; but it is only a short time since the first of his eight volumes was translated into English under the auspices of Dr. D. Sharp and Mr. F. Merrifield. We do not know if the series is to be continued in English, but the latest volume of the original shows no falling off either in the interest of the author's observations, or in the vivacious and agreeable French sentimentality of the diction, which reminds us of Alphonse Karr, and which forms so great a contrast to the humorous style of some of our English writers on similar subjects—Mr. E. H. Aitken, for example. So does the difference in national character show itself even in the style of popular books on natural history.

In his latest volume M. Fabre introduces us to Rose-Beetles; the beetles which destroy peas and beans; Pentatomas and Masked Bugs; Aphides and their enemies; wild bees (*Halictus*); carrion-flies and beetles; wasps and *Volucellæ*; and, finally, to various spiders whose nests are compared with those of the "Mésange Penduline" (Penduline Titmouse).

There are some text-illustrations, chiefly representing eggs, cocoons, and nests, many of very elegant form, among the most curious being the eggs of Pentatomidæ on p. 69.

Occasionally M. Fabre sees reason to question the observations of former writers. Thus he has been unable to confirm the statement that *Pentatoma griseum* watches over its young like a hen over her chickens, or that the favourite prey of *Reduvius personatus* is the bed-bug; nor does he regard the superficial resemblance between *Volucella* and a wasp as having anything to do with mimicry. The relation of *Volucella* to the wasp seems to be that of a simple scavenger. We have not space to quote M. Fabre's observations, but one interesting point which he discusses, not for the first time, is the limitations of instinct. This is illustrated in the case of the common wasp. When its nest is covered with a bell-glass, the enclosed wasps never dig a passage out, but remain cooped up till they die; and though stragglers left outside will dig their way in, they are equally unable either to show their companions the way out or even to make their own escape.

*Index Animalium*, 1758-1800. A CAROLO DAVIES SHERBORN confectus. Cambridge University Press, 1902.

"THE objects of this work," says the author, "are (a) to provide zoologists with a complete list of all the generic and specific names that have been applied by authors to animals since January the first 1758; (b) to give an exact date for each page quotation; (c) to give a quotation for each reference sufficiently exact to be intelligible alike to the specialist and to the layman."

Although Mr. Sherborn has received help from many quarters, this has but lightened in some small degree a truly colossal task, which, indeed, the author scarcely hopes to finish in his lifetime.

The value of this undertaking to zoologists cannot be easily estimated. A solid foundation has at last been laid on which to base a definite system of nomenclature, though, having regard to the wilfulness displayed in certain quarters, this seems almost too much to hope for!

This first volume, in the matter of binding and printing, is in every respect worthy of the Cambridge University Press. It is a bulky book, embracing no less than 1195 pages.

## MISCELLANEOUS.

*On the Classification of the Thalassinidea.*

By L. A. BORRADAILE, M.A. &c.

### ADDENDUM.

On p. 540, to the list of genera of the Laomediidæ, add: *Naushonia*.

On p. 541, after the definition of the genus *Jaxea*, add:

Genus NAUSHONIA, Kingsley, 1897.

Definition: "Laomediidæ which have on the maxillipeds of the first pair a lash to the exopodite and a podobranch, the first pair of legs stout and subchelate, the second pair very short and simple, and a well-developed, flat scale on the antenna."

Species:

Type. *N. crangonoides*, Kingsley, 1897. Bull. Essex Inst. xxvii.

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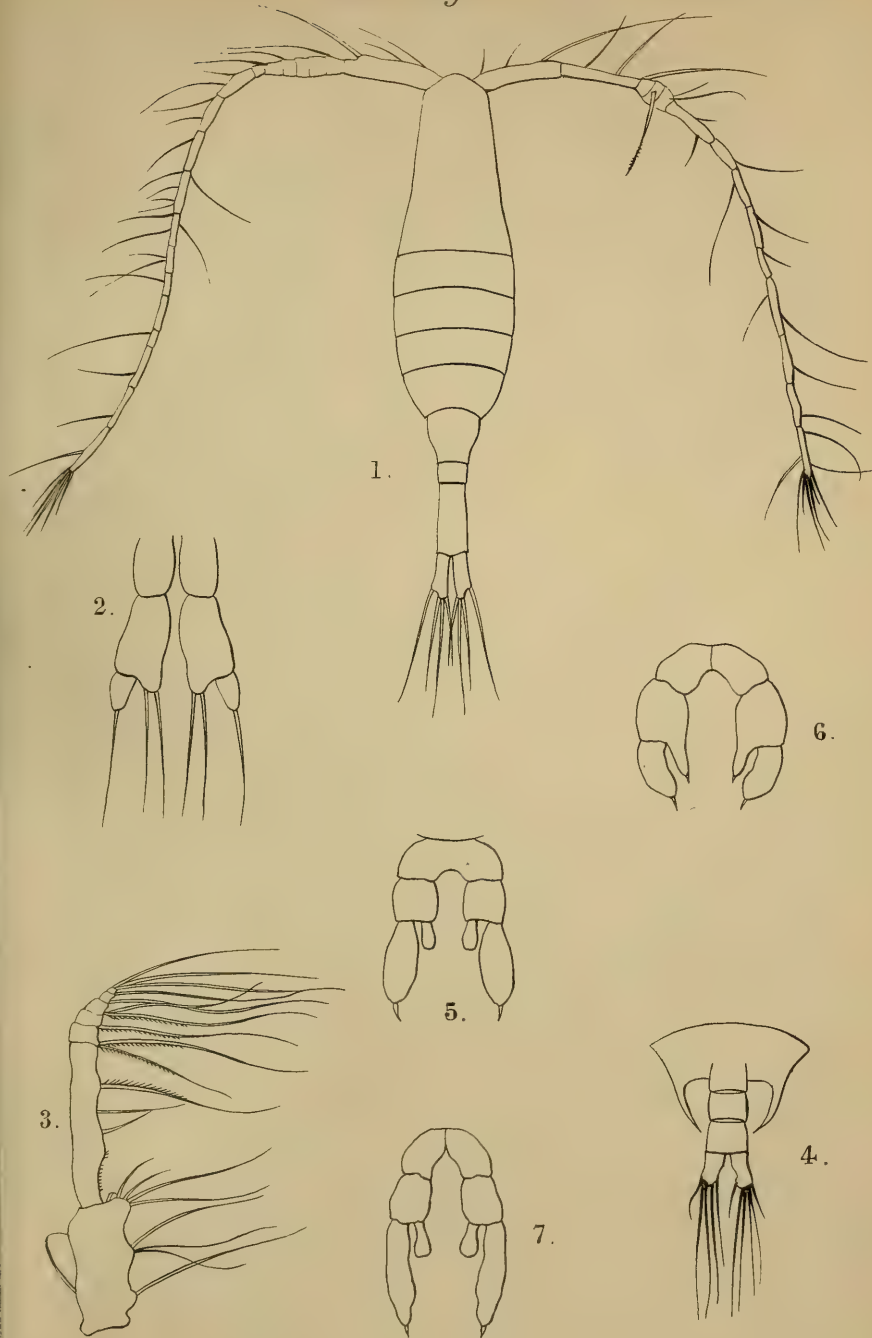
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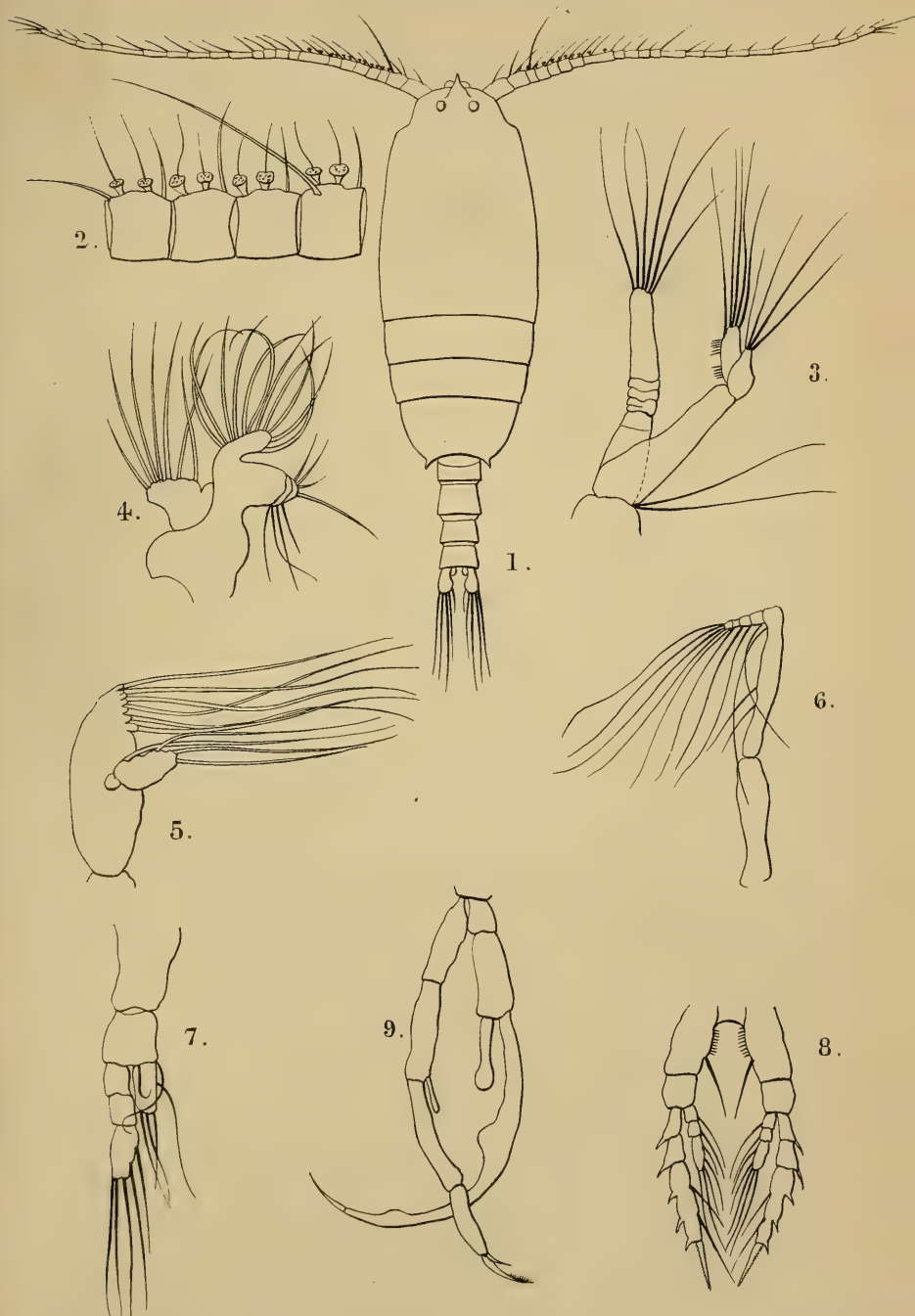
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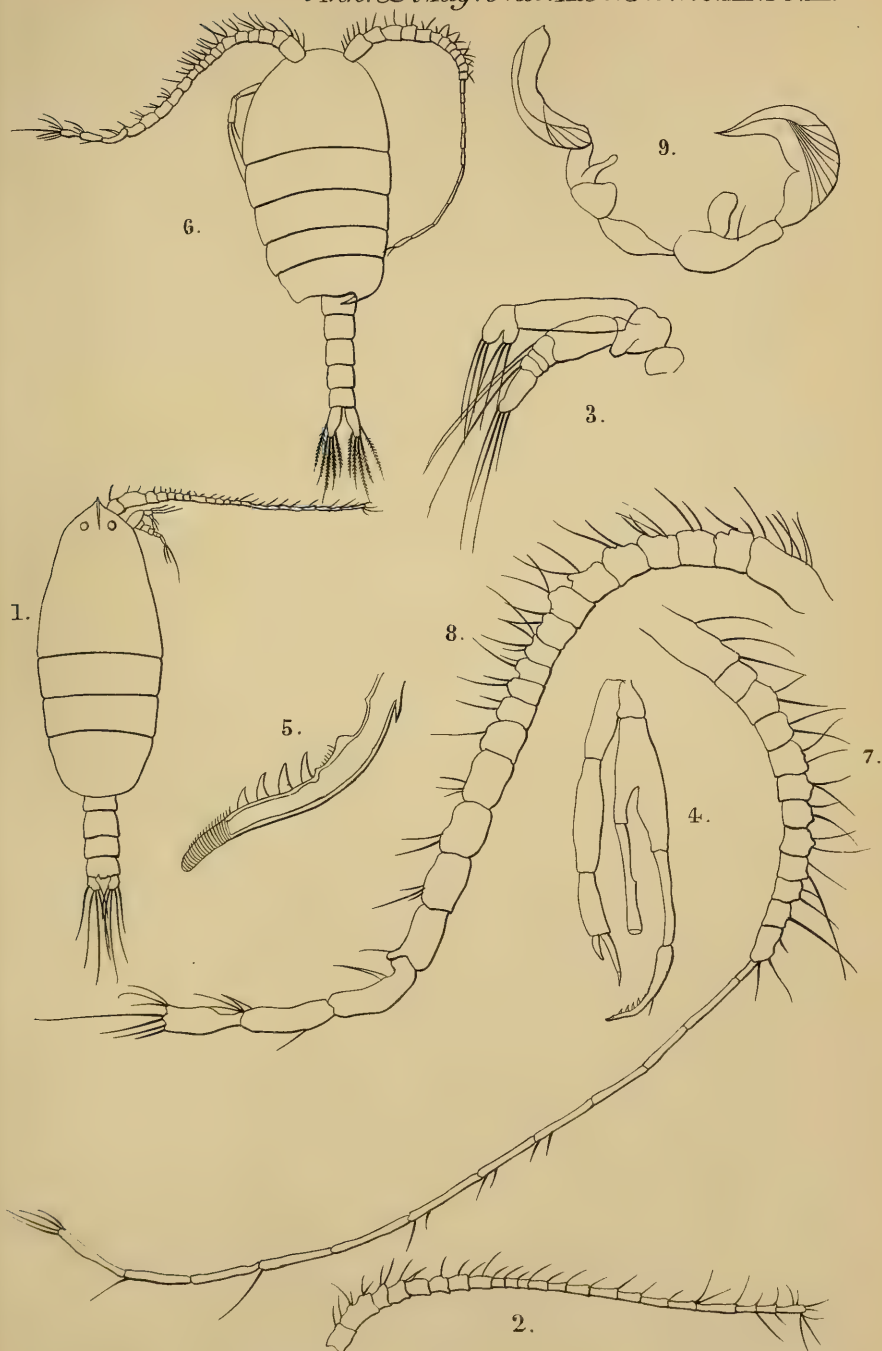






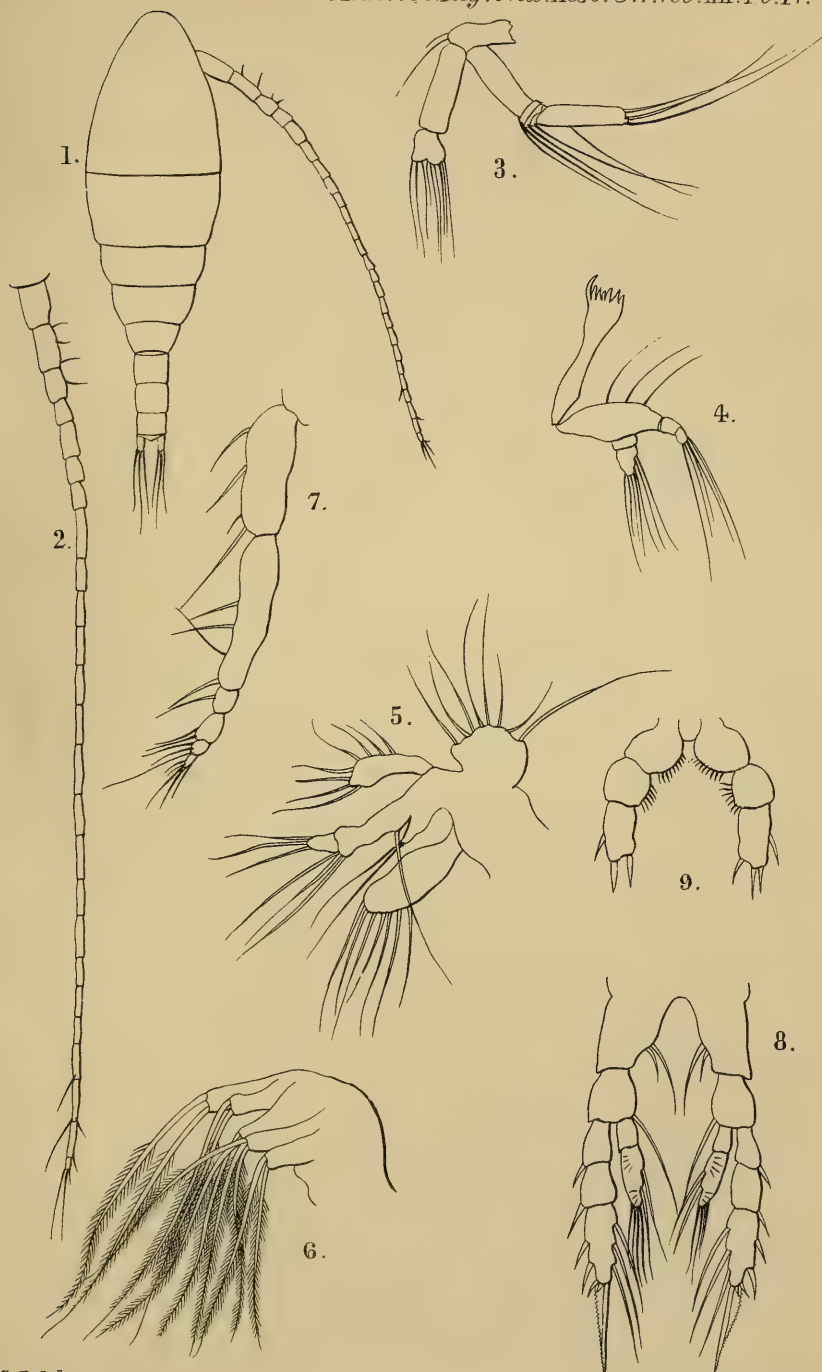




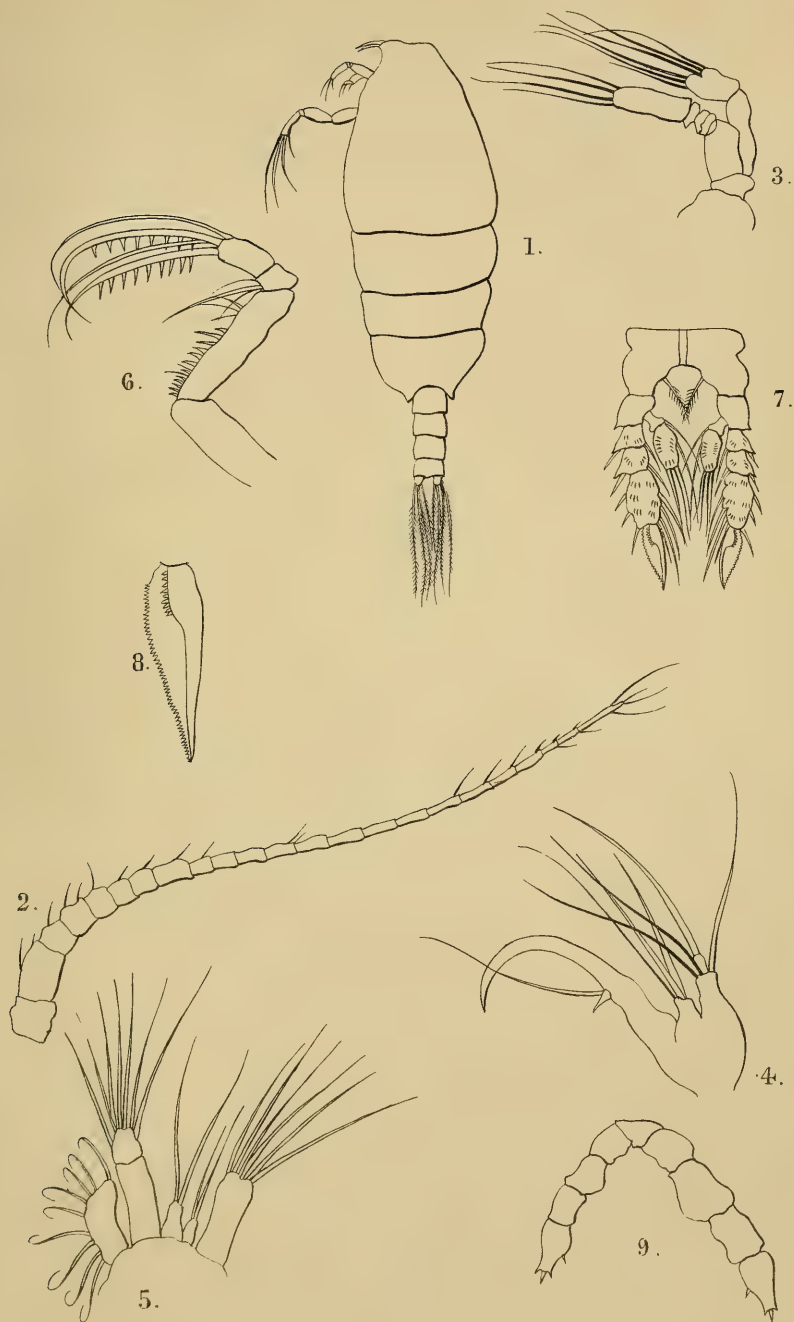






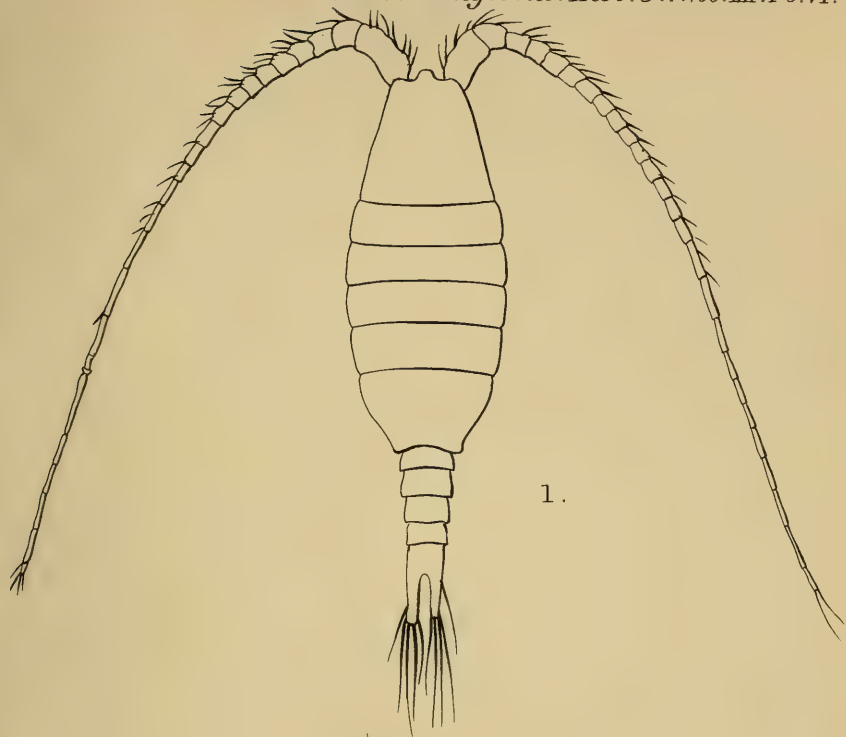




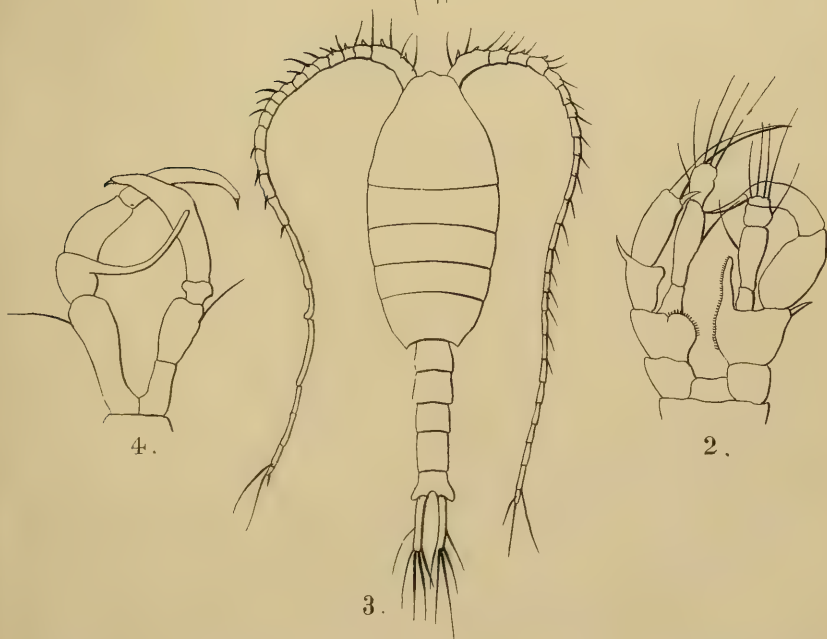








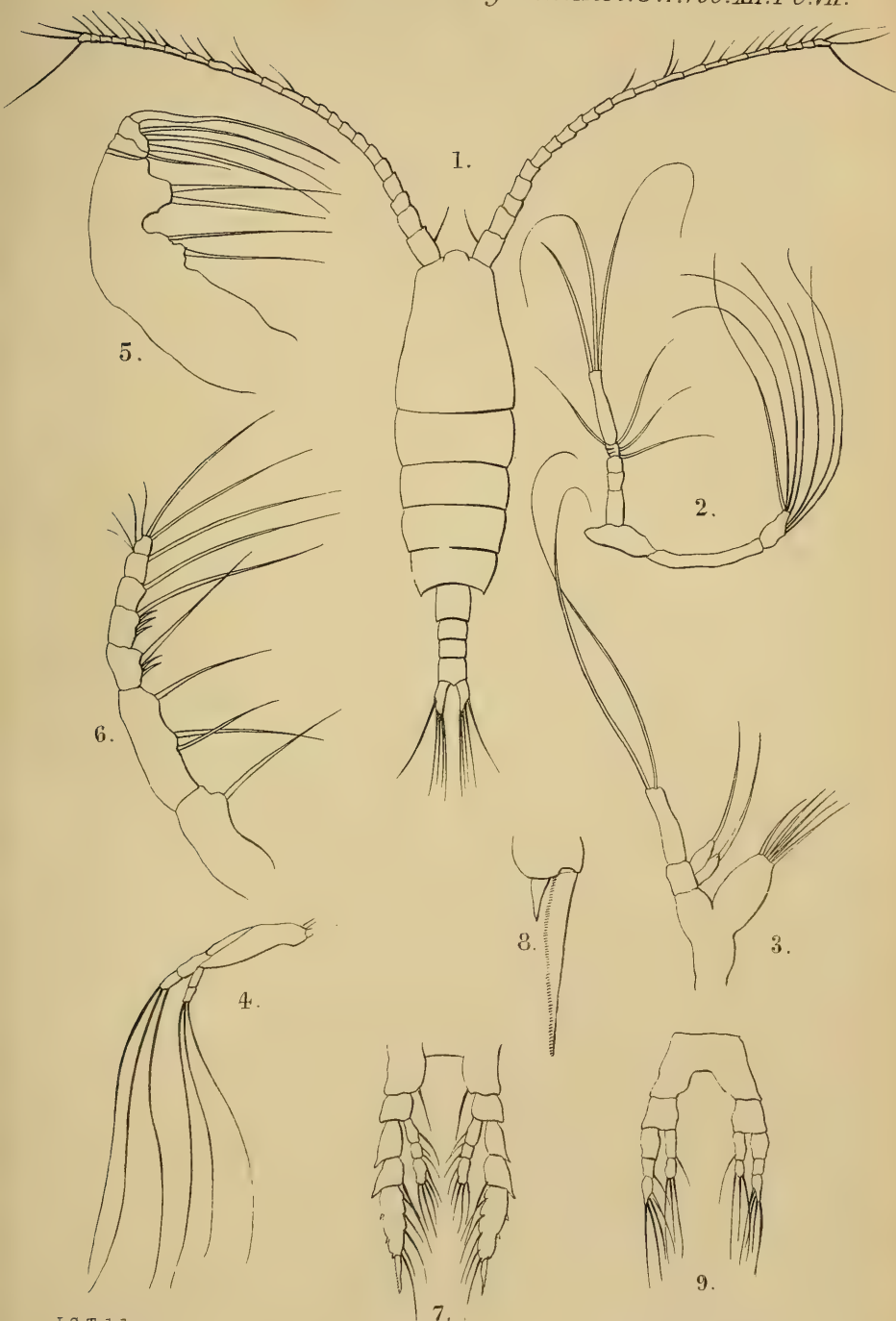
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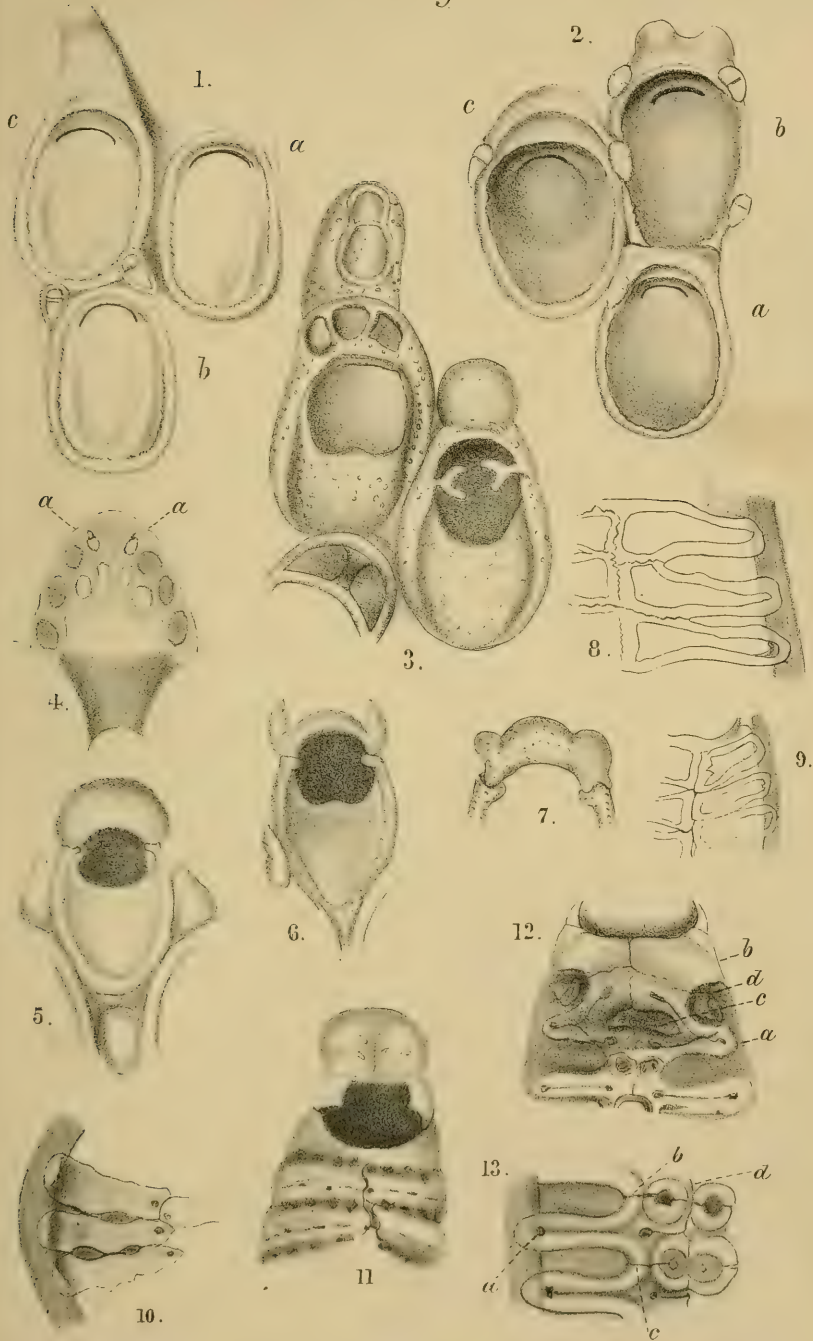
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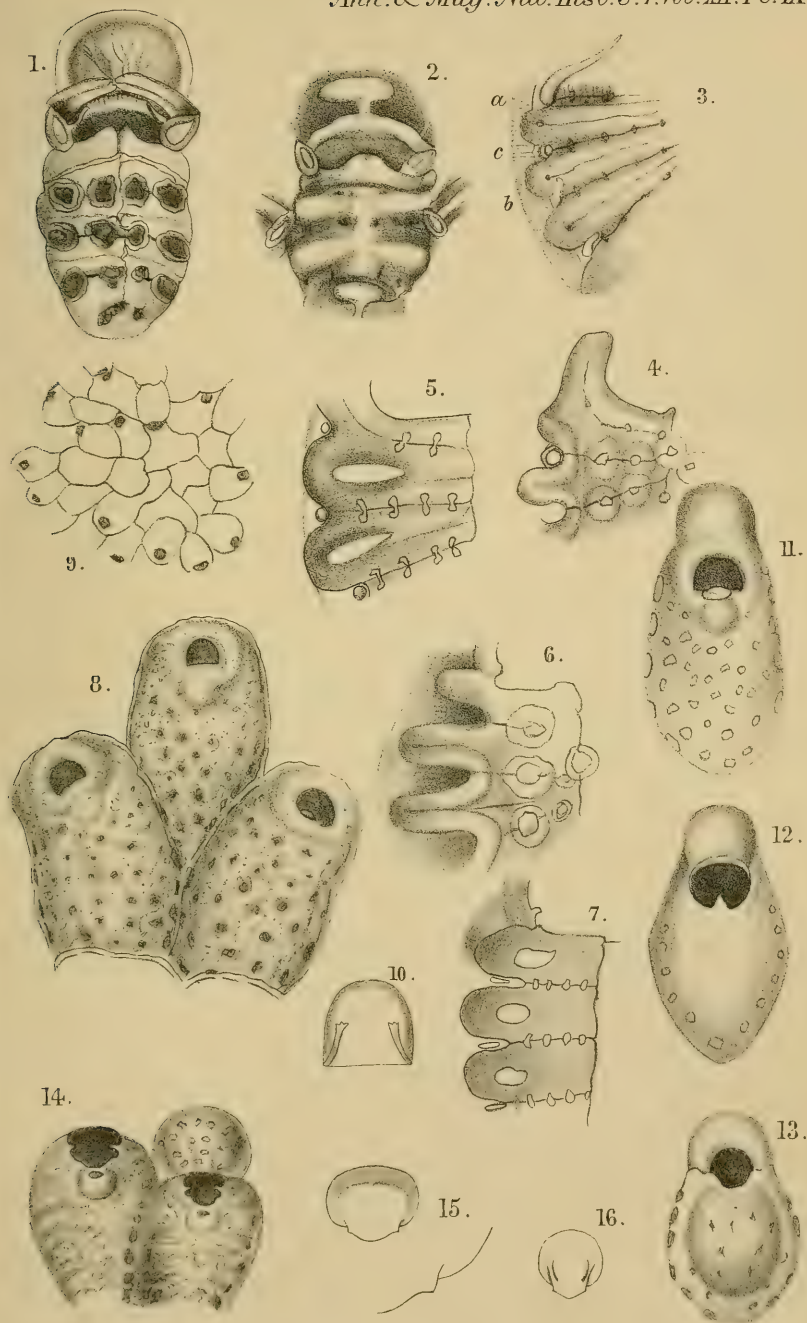










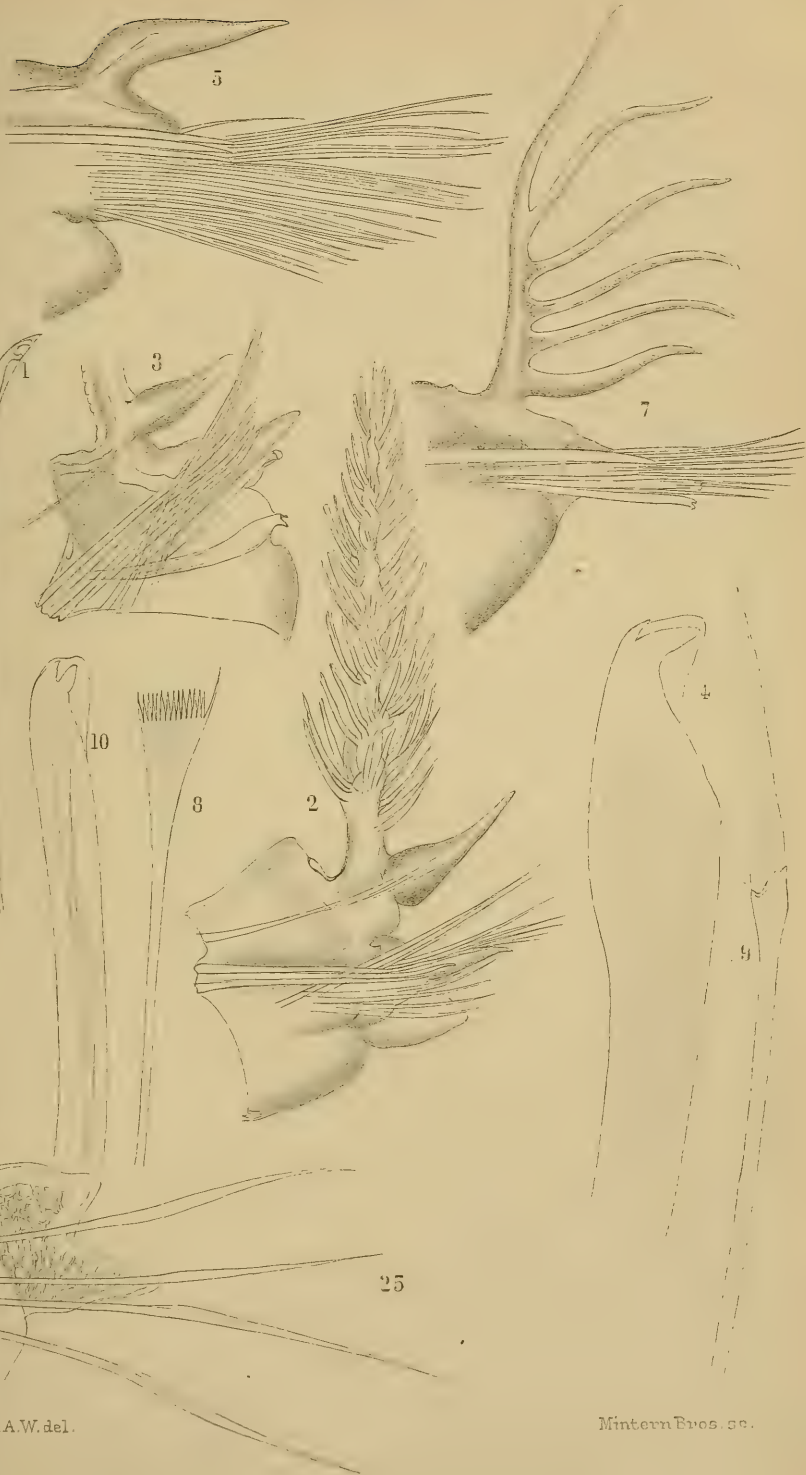






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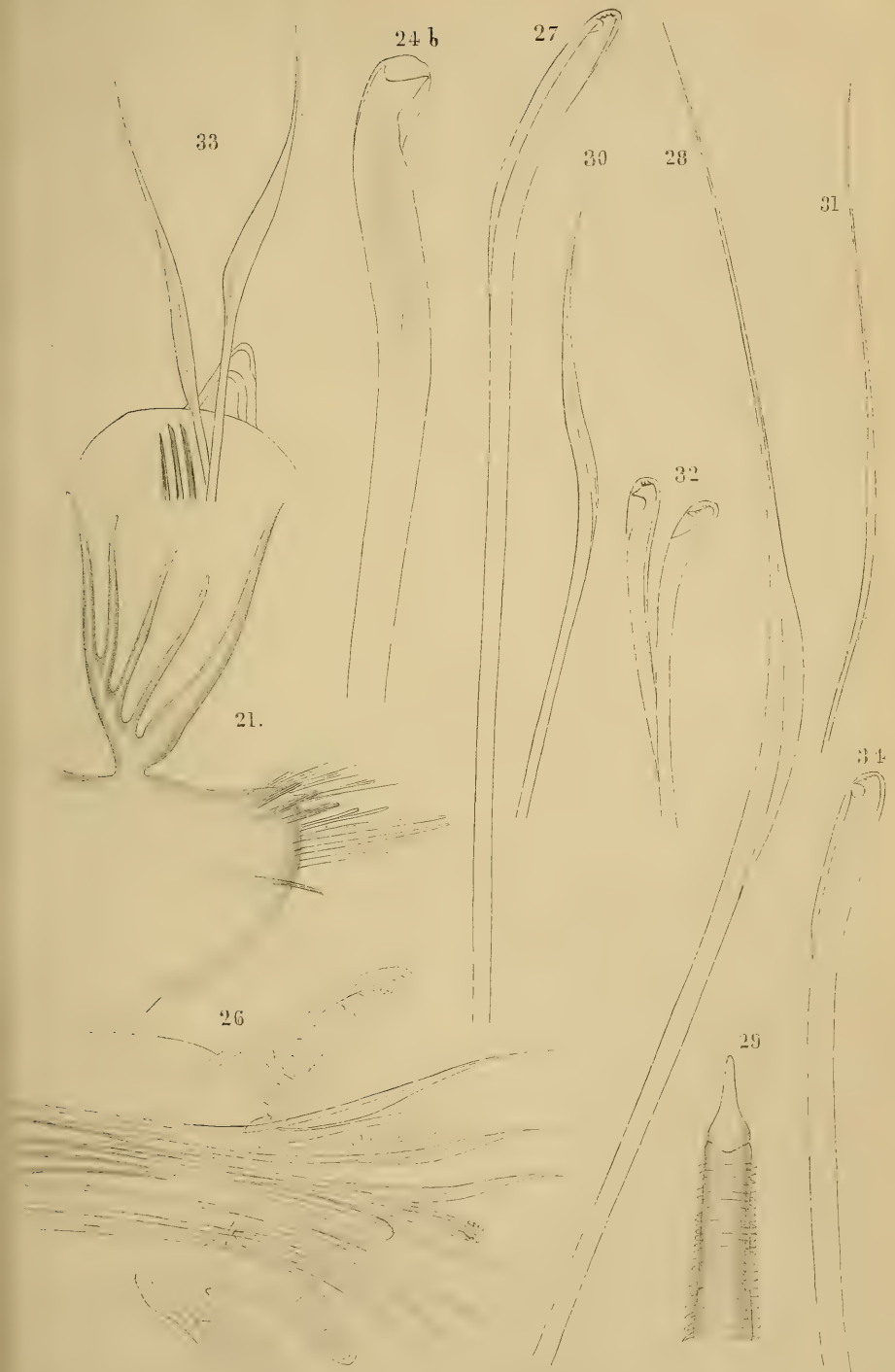














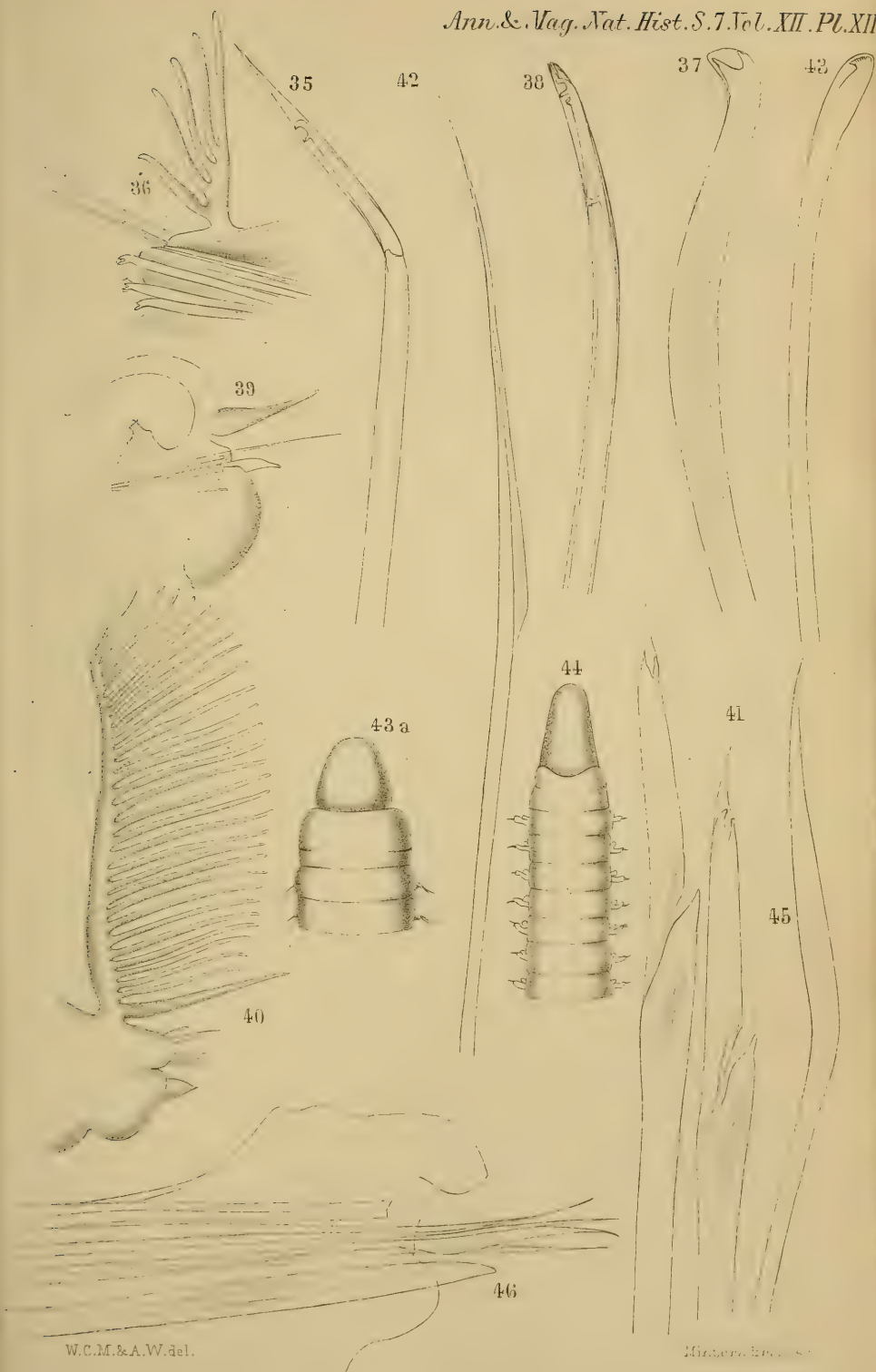






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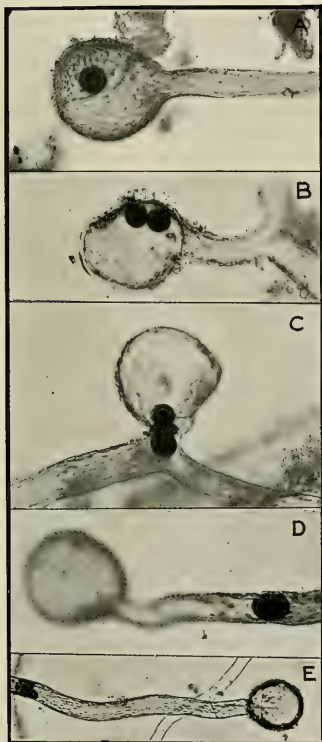


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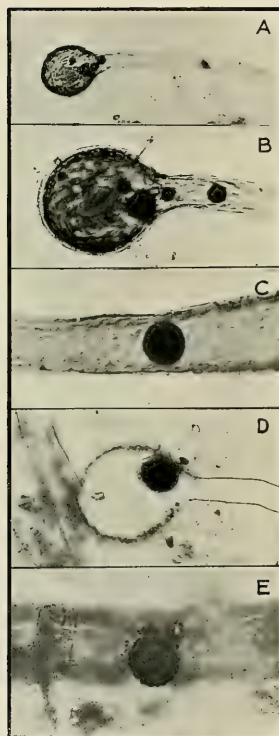


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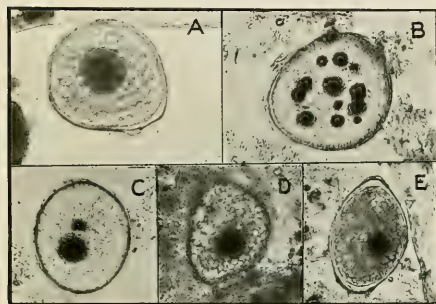
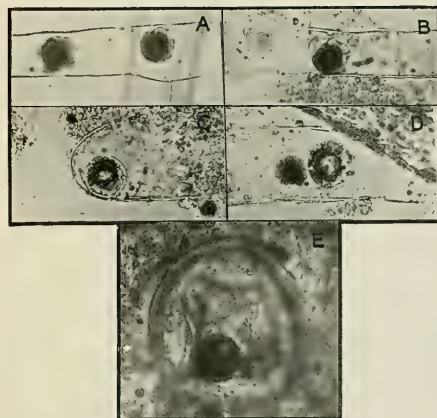


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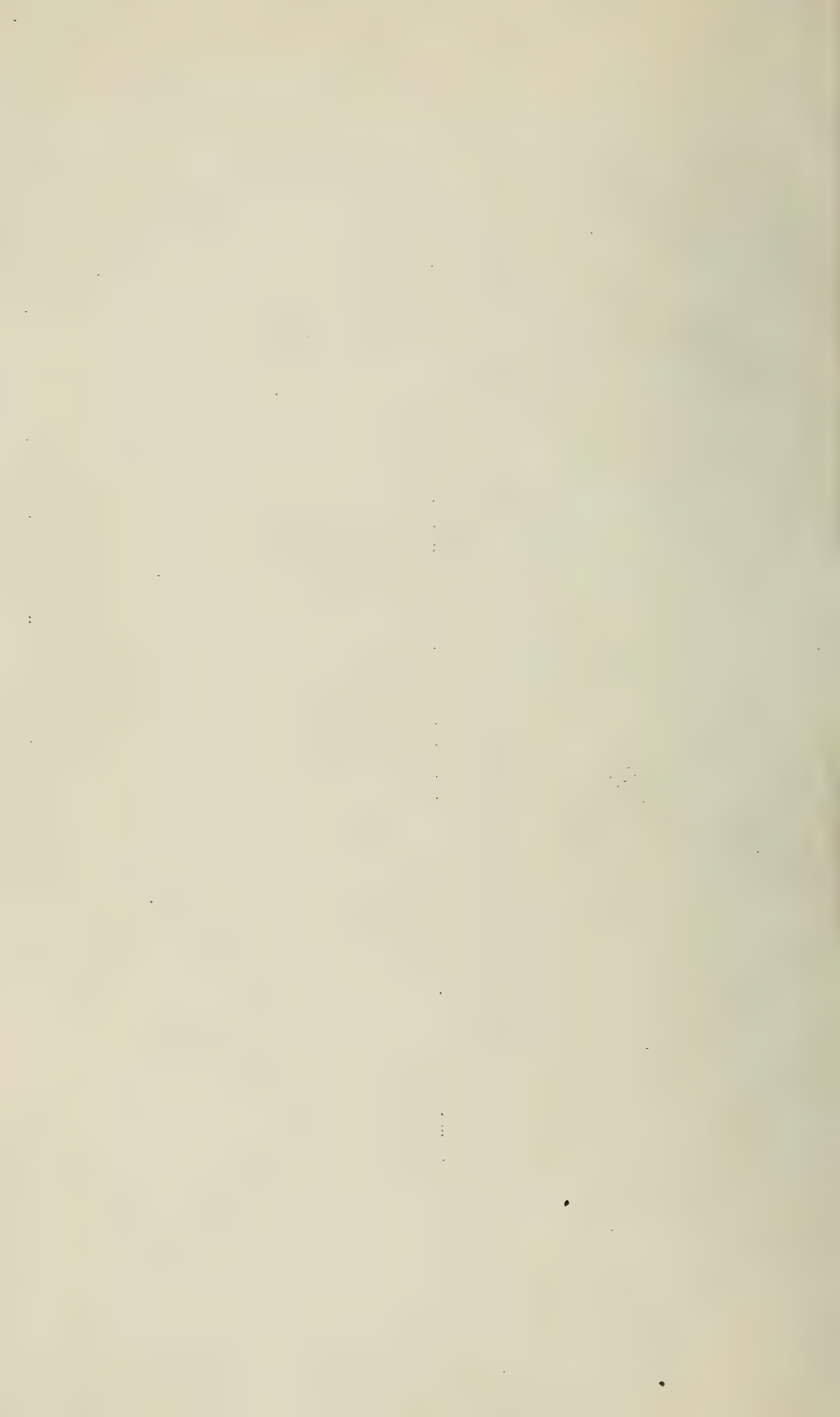


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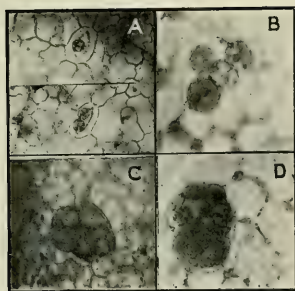


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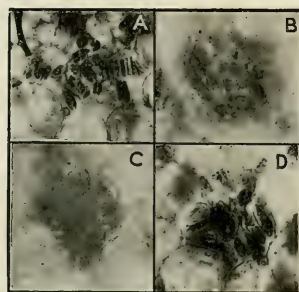


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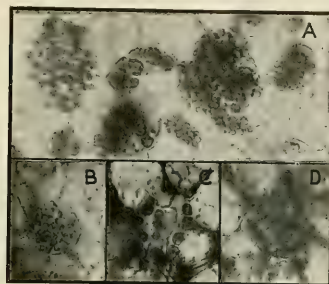


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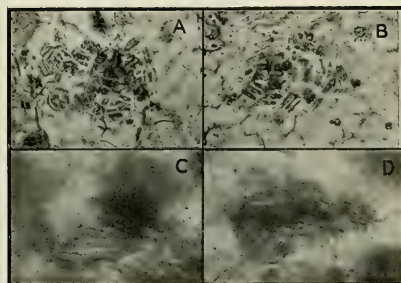


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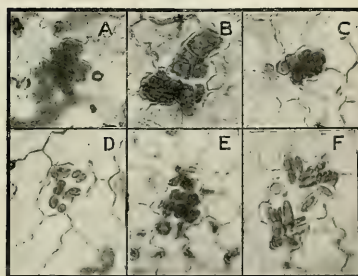
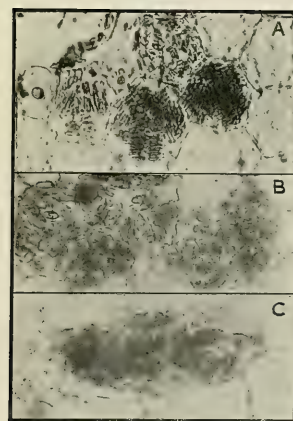
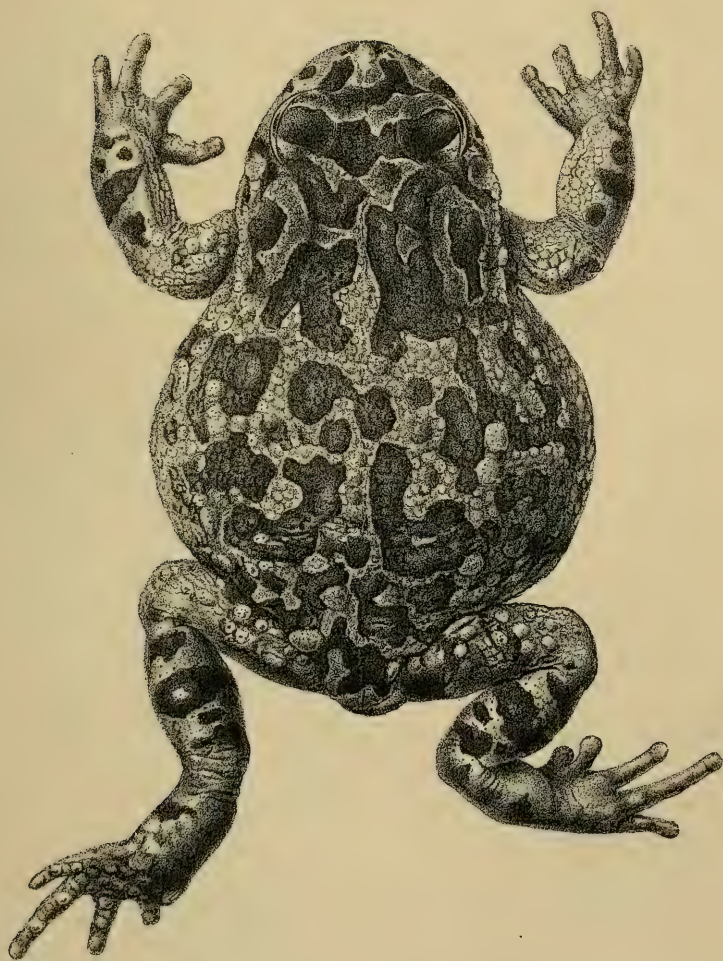


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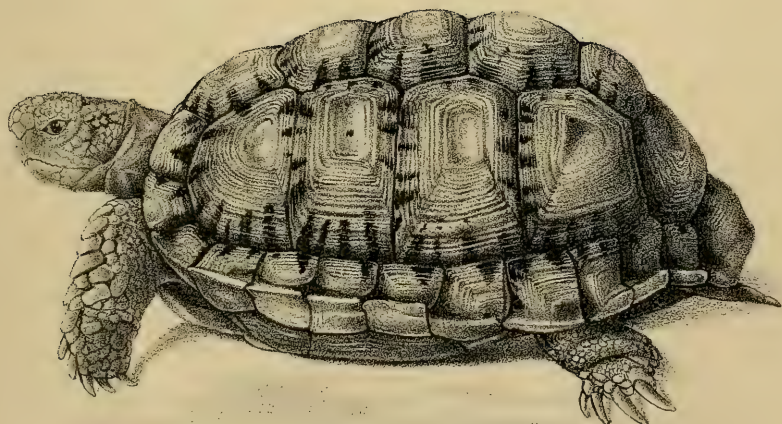
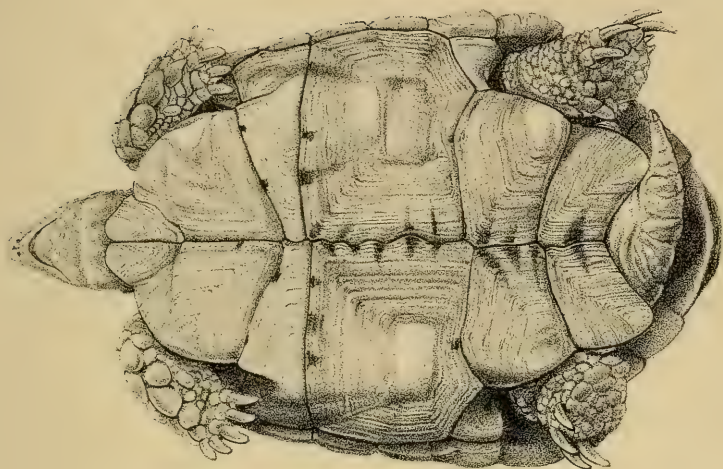






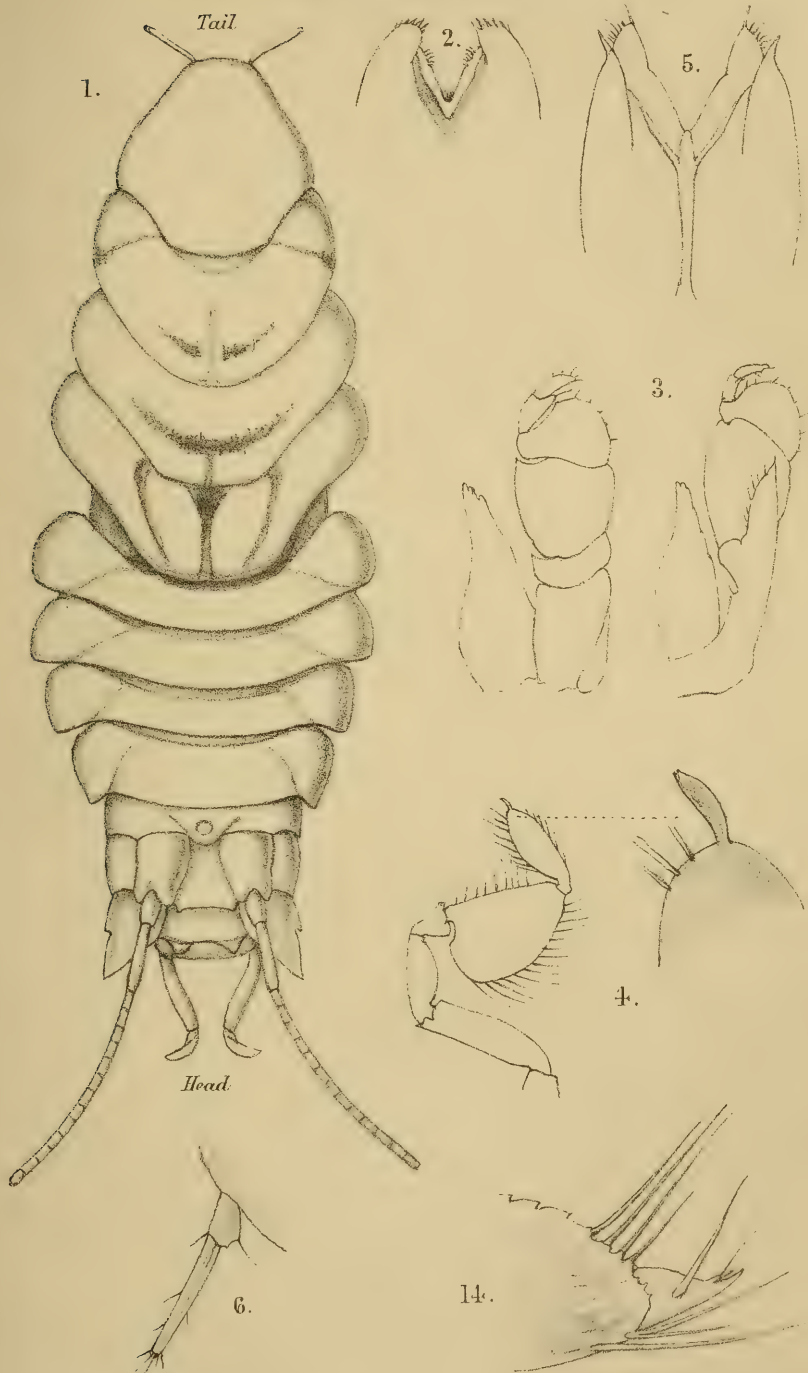




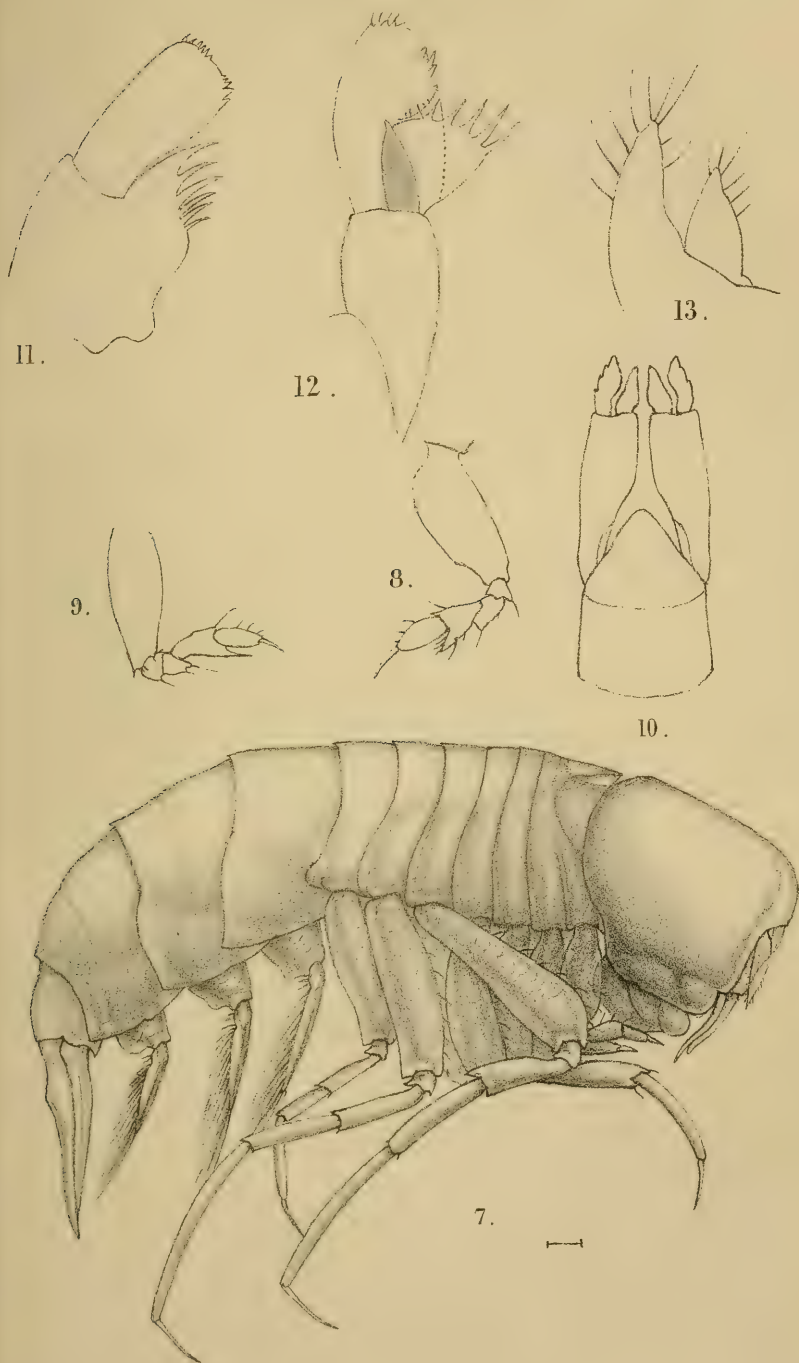






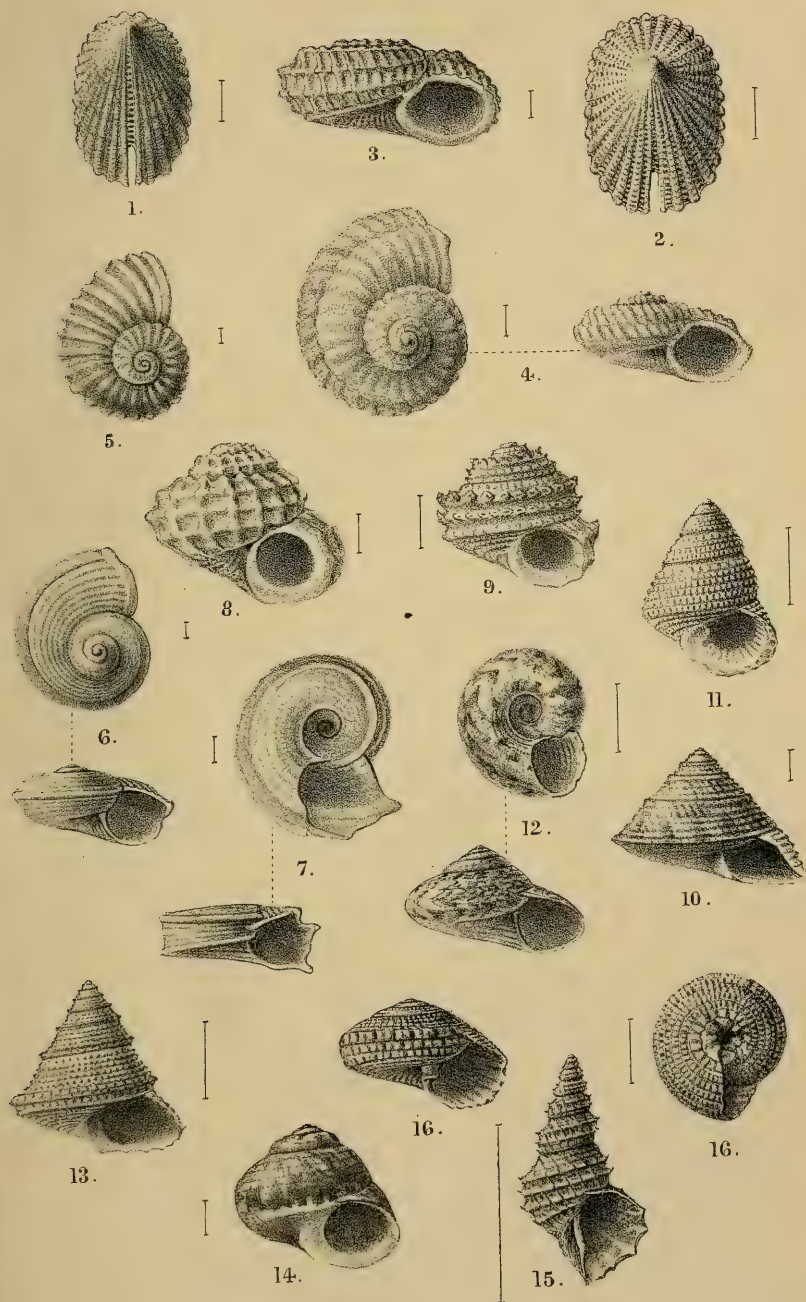




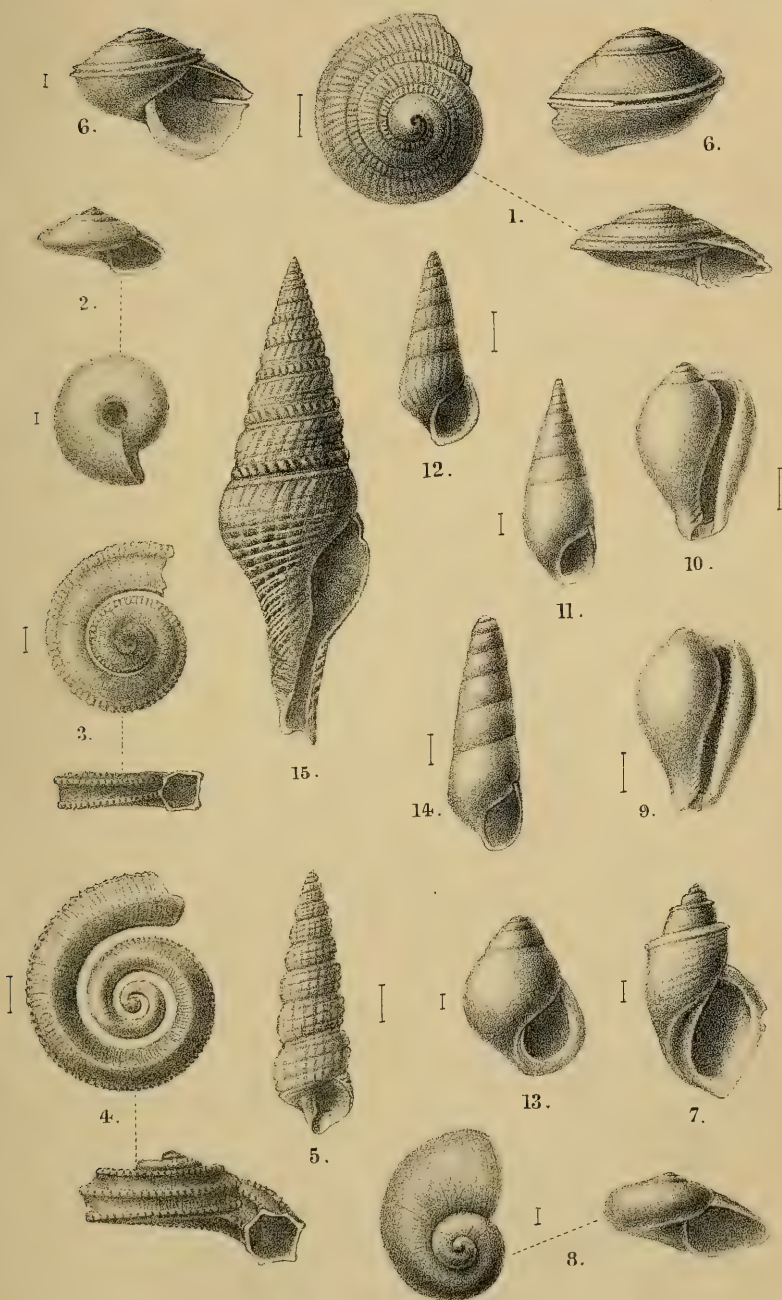






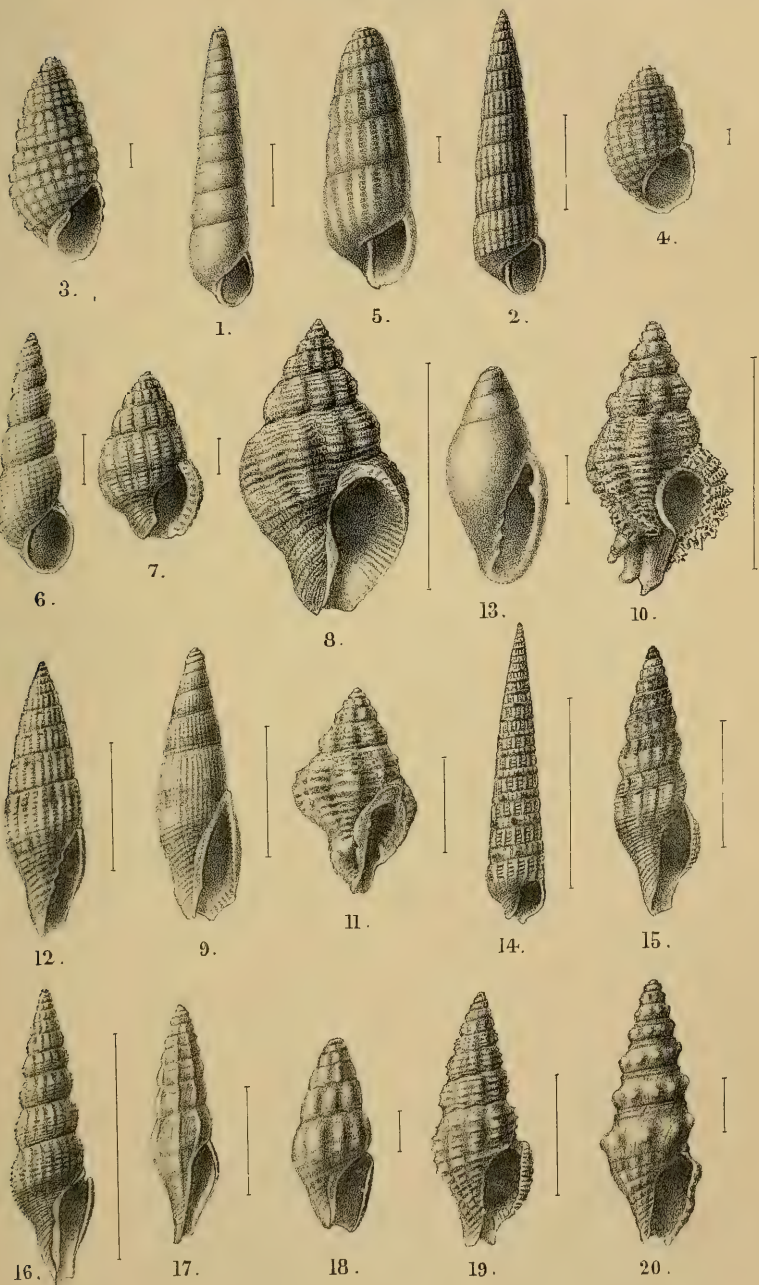




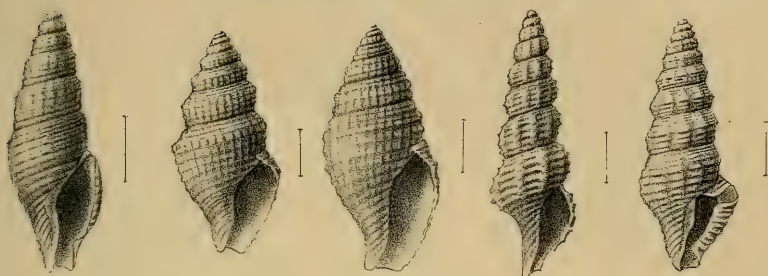












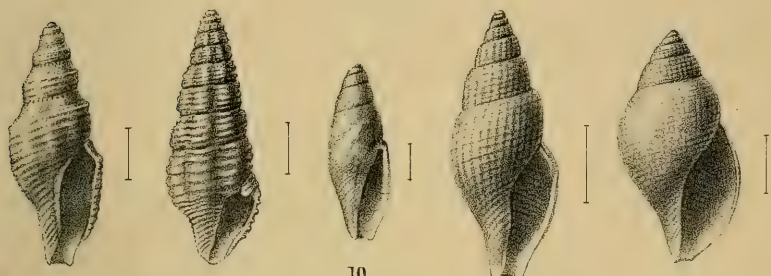
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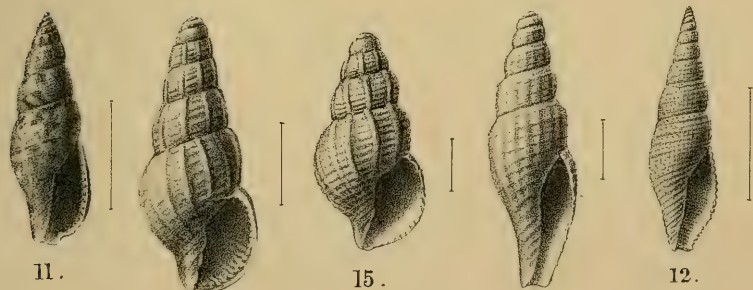
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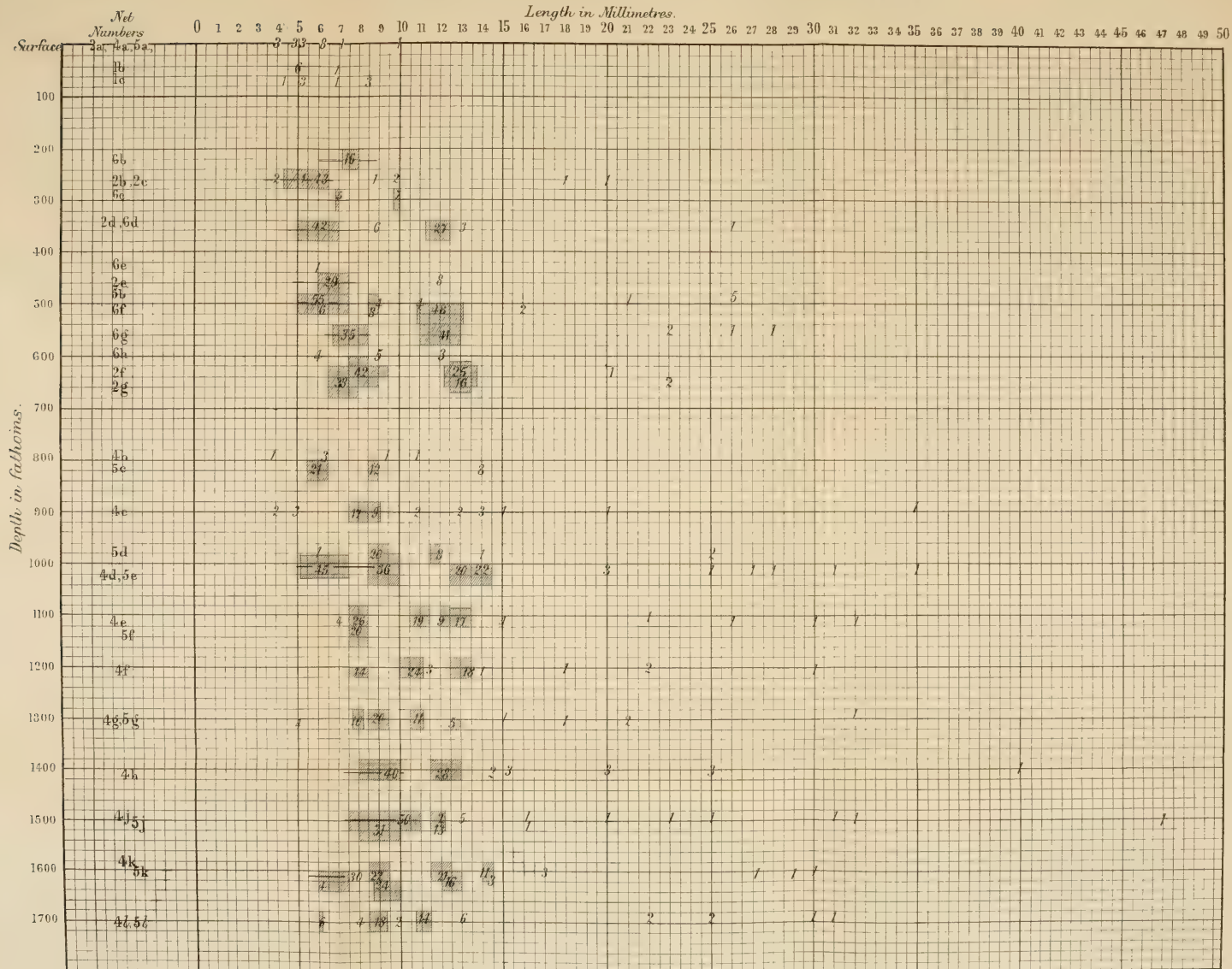




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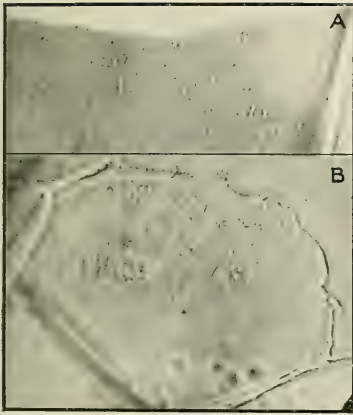


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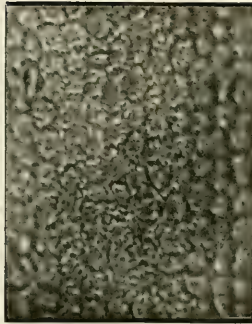


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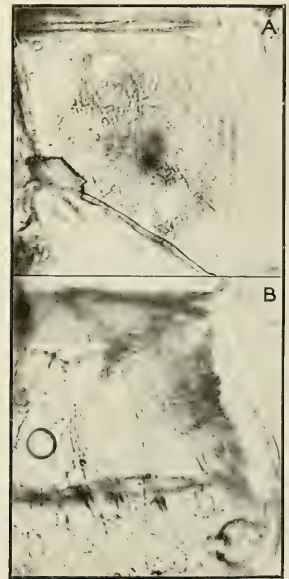


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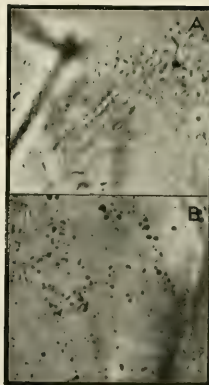


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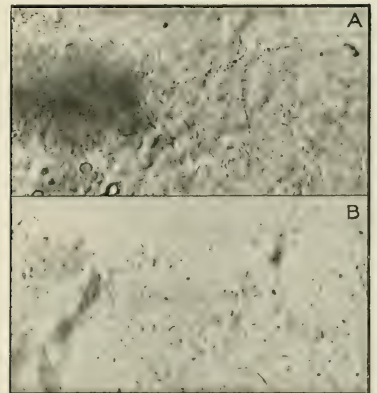






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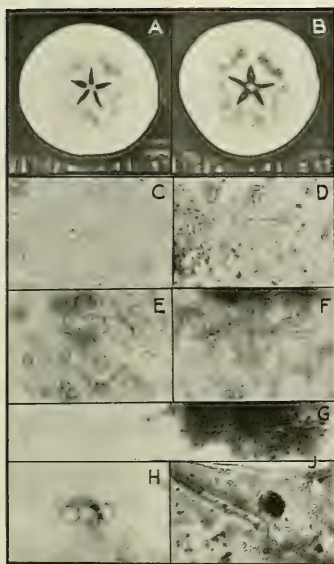


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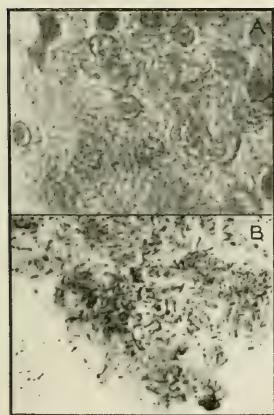


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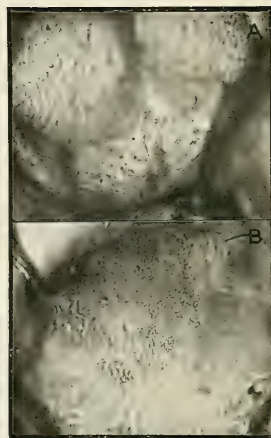


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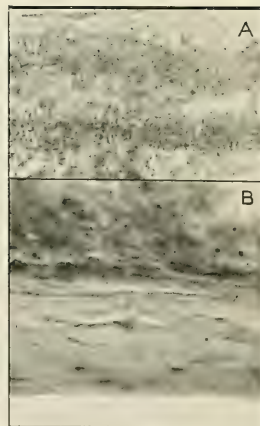


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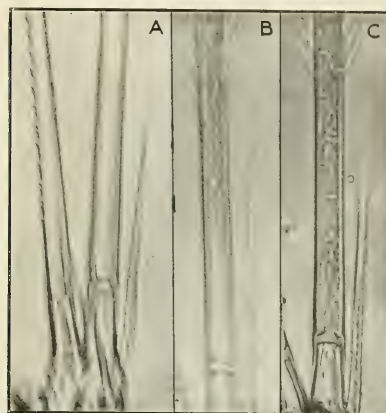
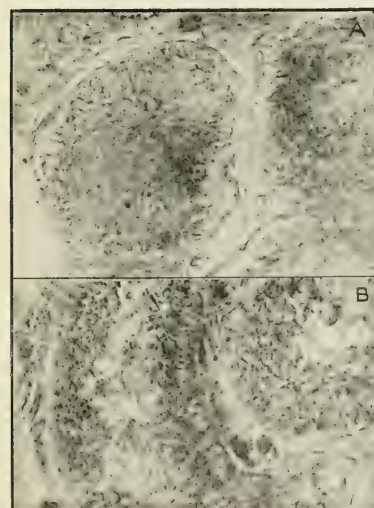
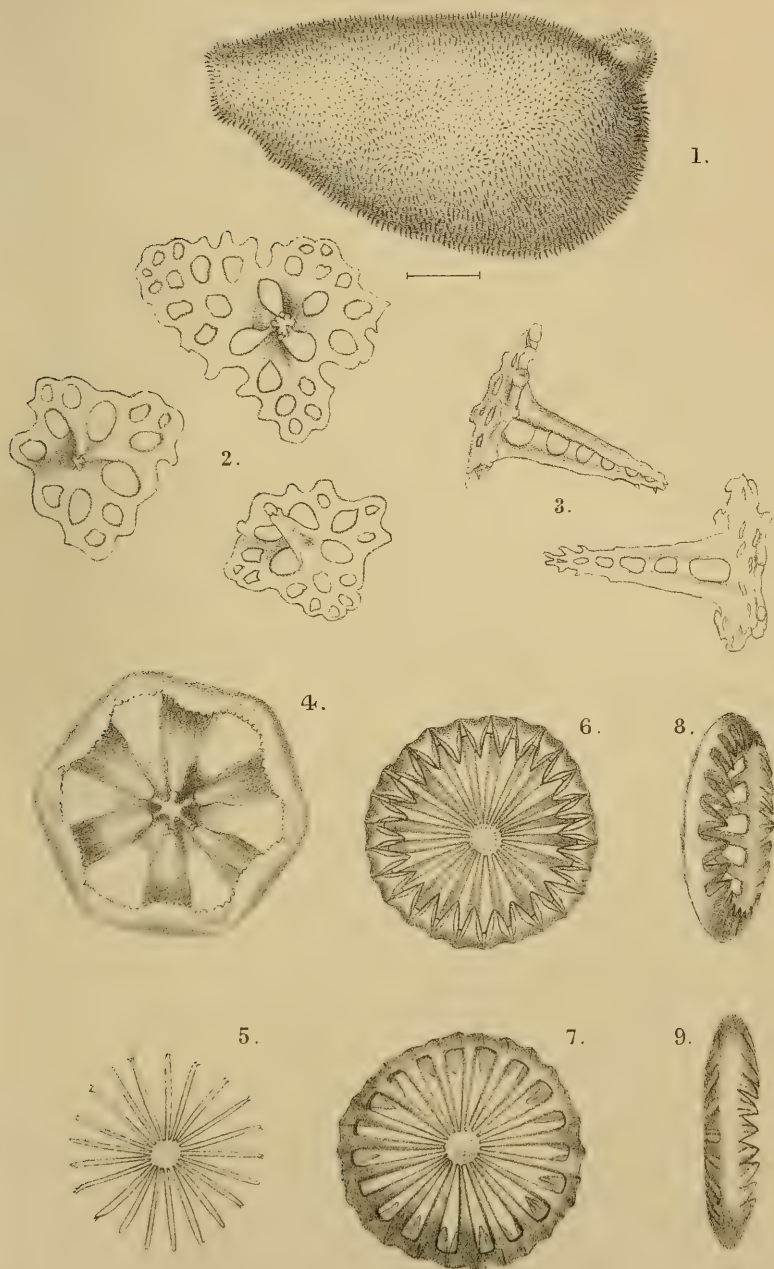


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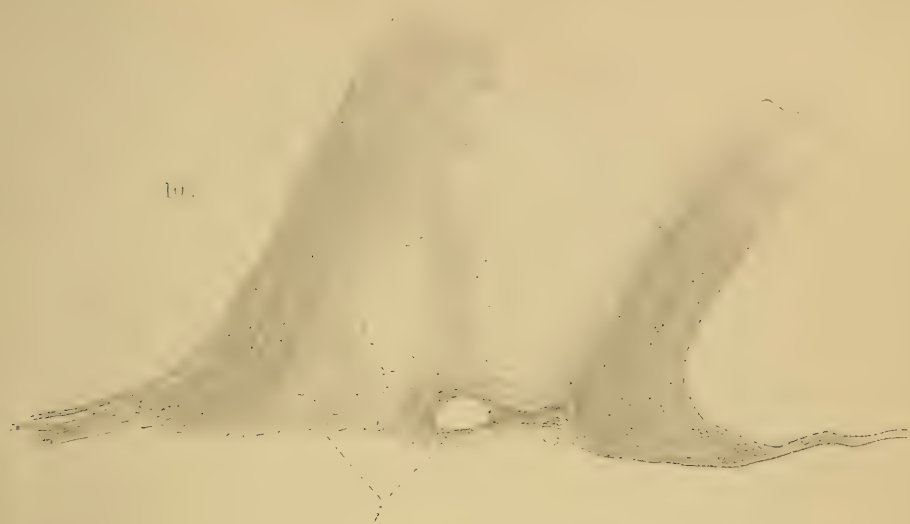








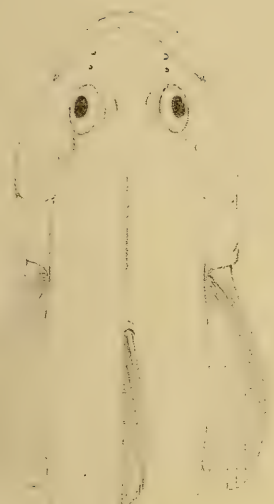
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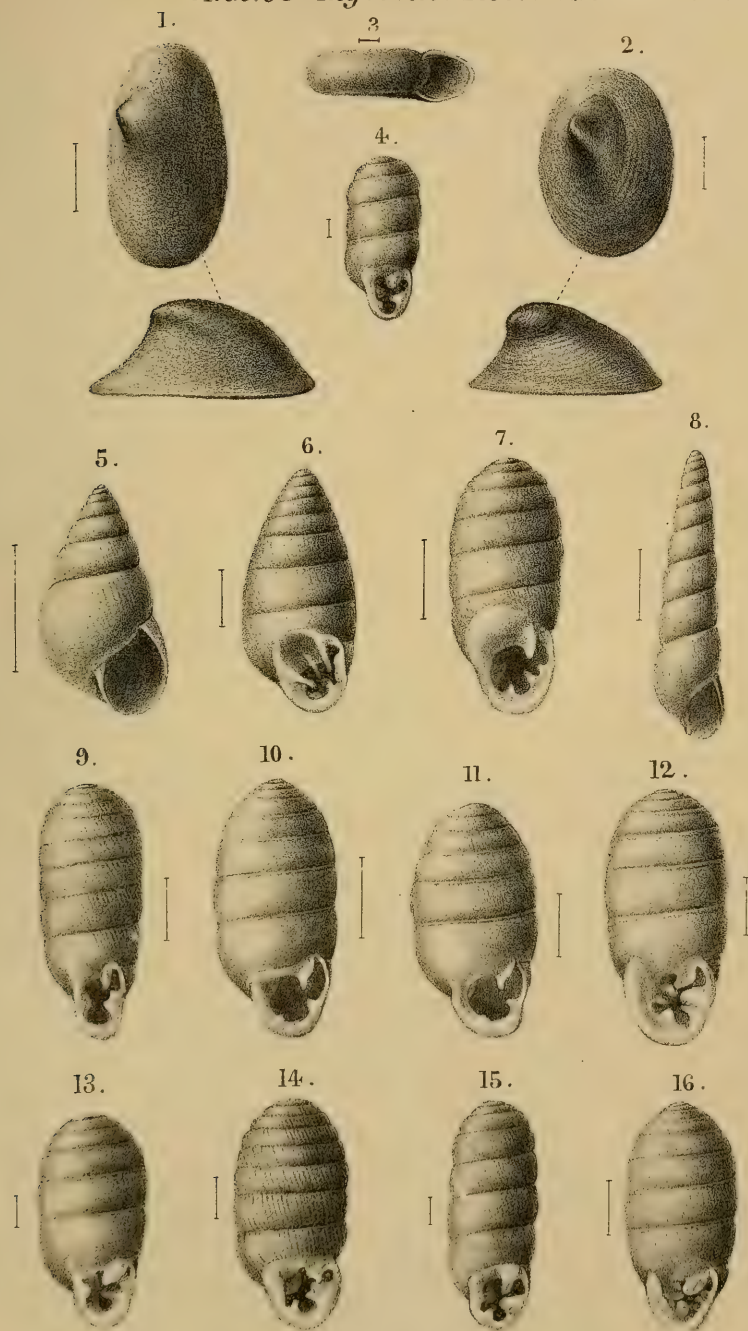
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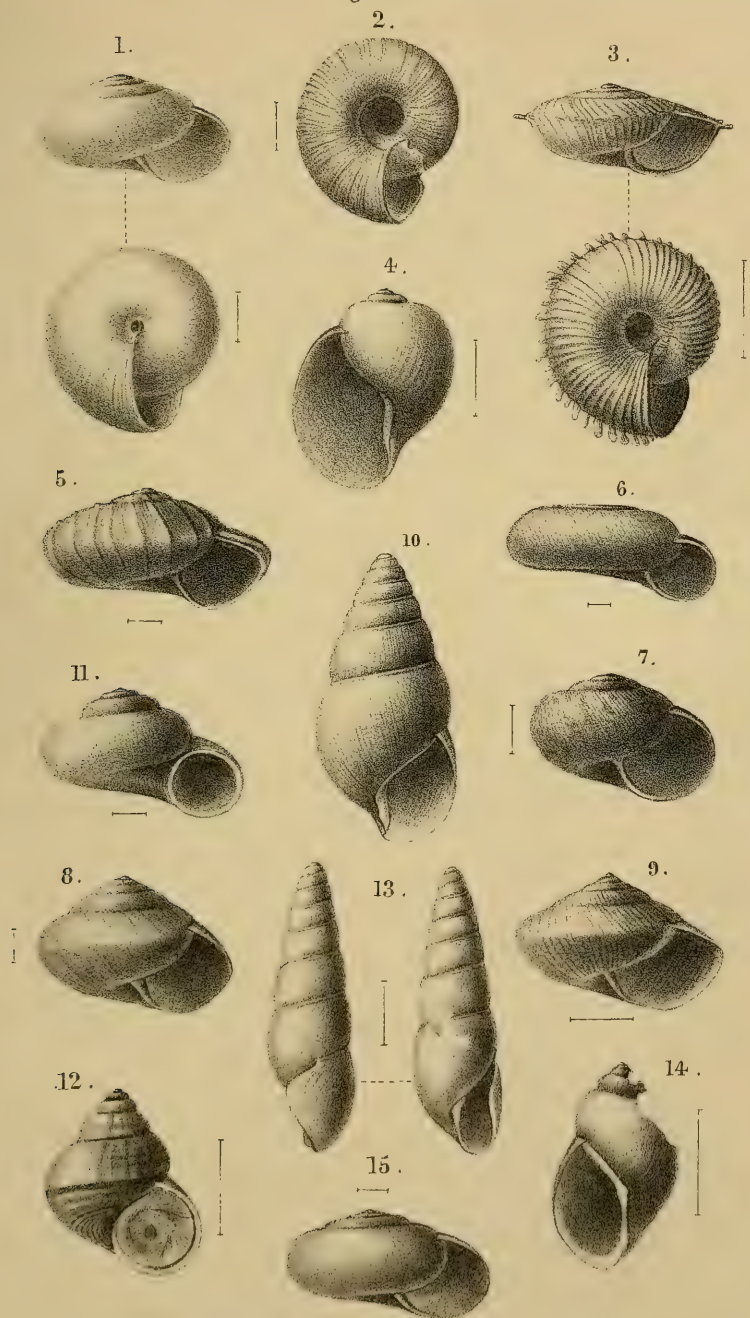
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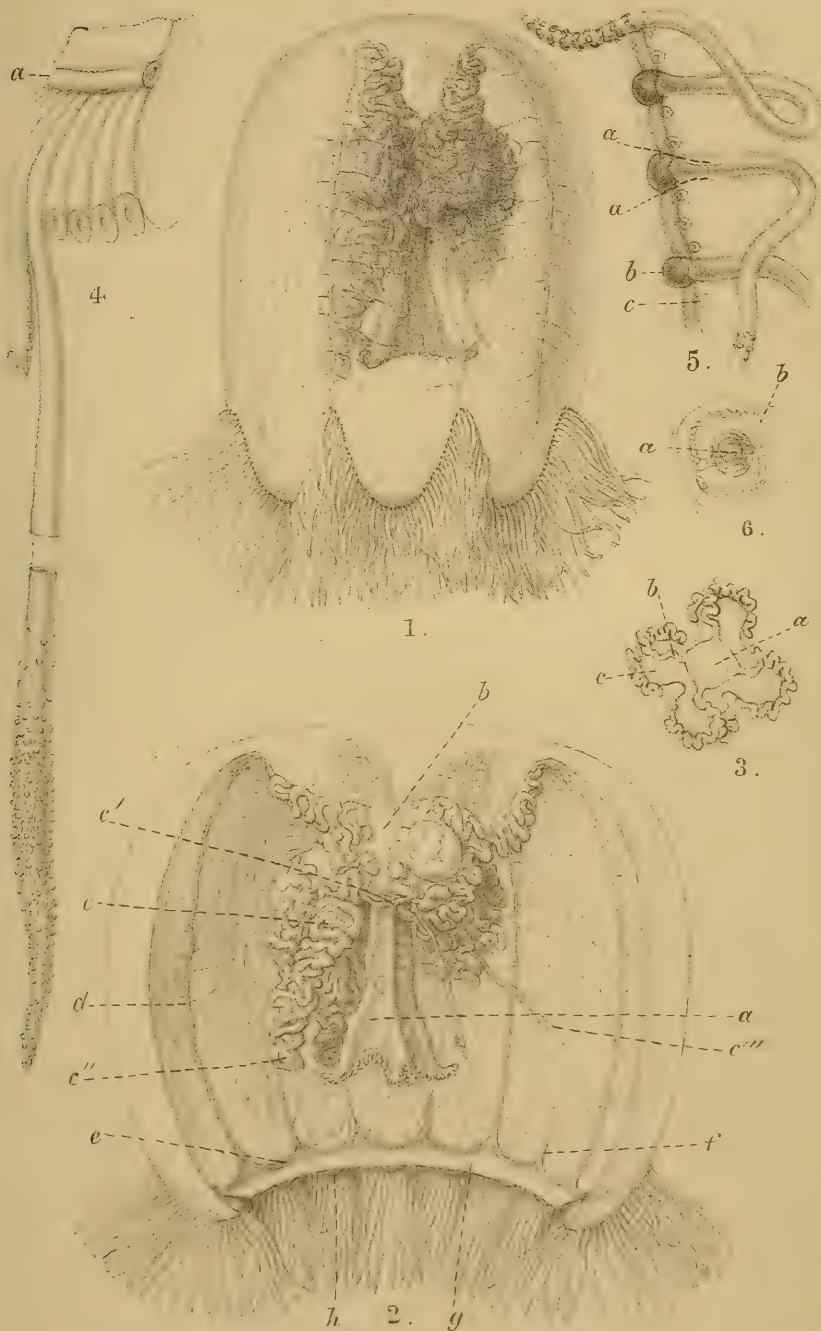


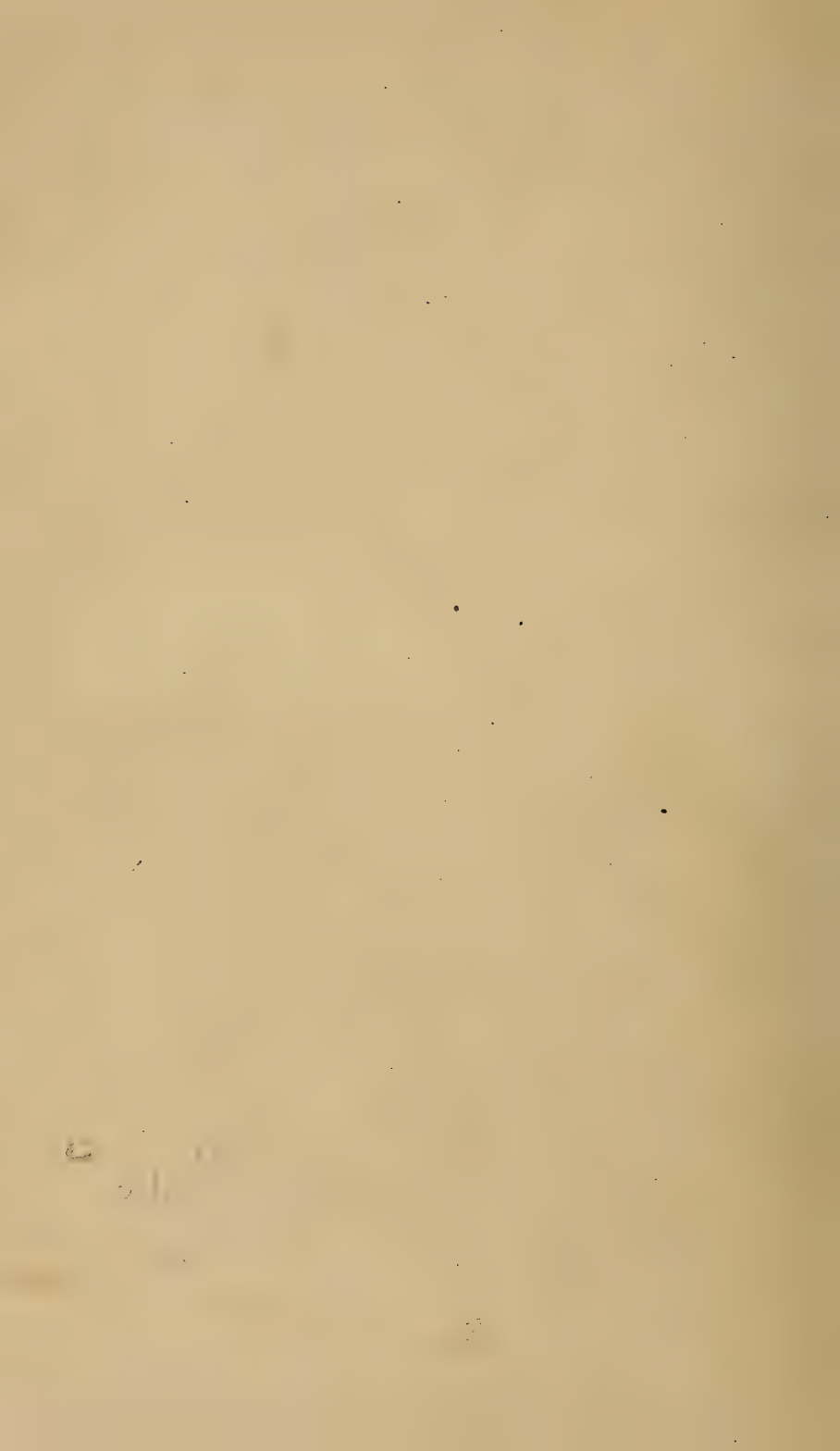




















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